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VOL. VII NOVEMBER, 1926 No. 11

ACTINOTHERAPY

Pathology: Tuberculosis

CLINICAL USAGE OF LIGHT AND ITS BASIC PRINCIPLES IN TUBERCULOSIS*

EDGAR MAYER, M. D.

Saranac Lake, N. Y.

THE curative role of light in certain forms of disease is now commonly accepted. In rickets and tetany under the influence of light the blood shows an increase in phosphorus and calcium, and calcium deposition takes place in the epiphyses of the long bones. Clinically in tetany the disappearance of such symptoms as carpopedal spasms, laryngeal spasms and convulsions after exposures to quartz-mercury vapor irradiations frequently takes place. Lupus vulgaris has been reported to heal by combined local and general carbon arc exposures in almost 90 per cent of cases. Extrapulmonary tuberculosis in many forms yields to treatment with artificial light as well as with sunlight radiations. These results have been so clear-cut in a large number of cases that a knowledge of light and its clinical applications is fast becoming important to the practitioner of medicine.

Sunlight and air therapy owe their impetus particularly to the work of Rollier at Leysin, and Bernhard at St. Moritz, Switzerland. In America, this treatment has been advocated by the Perrysburg School, including LoGrasso, Pryor, Hyde and others. Solar therapy as practiced by these workers, includes increasing graduated exposures of parts of the body to sunlight. This phase of light treatment is to be discussed by the Perrysburg workers in another issue of The Archives. It is the aim of this paper to consider chiefly the treatment of disease by means of artificial light sources.

The pioneer workers in the field of artificial light therapy have been those of the Copenhagen (Denmark) Institute,

*Received for publication July 14, 1926.

especially Finsen and his followers, Reyn and Ernst. Finsen emphasized the local application of carbon arc light to superficial tuberculosis. Reyn and Ernst stressed general body application with artificial sources as carried out by others with sunlight. In England, Sir Henry Gauvain has utilized extensively the carbon arc light as well as other artificial sources, alternating with air and solar exposures. His results have been reported as splendid in many instances. Some of our results obtained by the use of artificial sources of light, more particularly the mercury-quartz light, have led to the presentation of this paper. Because of the broad scope of this field of therapy, only brief reference may be made to the more important facts.

NATURE OF RADIATION

Figure 1 represents the divisions of the spectrum of sunlight, showing the visible region limited on one end by infra red and on the other by ultra violet rays. The visible spectrum extends from about 760 mu. to about 390 mu. The ultra violet rays of sunlight extend from about 390 mu. to 290 mu. and those of artificial sources from about 390 to 185 mu. The ultra violet rays of a source such as the carbon arc have as their lower limit 220 mu. while those of the quartz-mercury arc terminate at 185 mu. These limits are said to vary with different individuals according to the sensitivity of the retina.

All wave lengths appear to possess some light and heat properties and the ability to influence chemical reactions. As a rule, however, heat production is chiefly associated with the infra red and the red rays. Light is chiefly associated with the rays from red to violet, while the most active rays chemically are the ultra violets. The blue, indigo and violet rays are to a lesser extent chemically active.

The infra red rays are highly penetrative except for water, while the ultra violet rays possess this power only to a limited degree. The regions of the spectrum vary greatly in their degree of absorption in different substances. Water and water vapor, for instance, absorb infra red rays to a very great extent. Quartz and fluorite and clear distilled water do not in any degree absorb ultra violet rays. Ultra violets lose about 60 per cent intensity in penetrating the atmosphere before reaching the lowlands. Ordinary window glass absorbs most ultra violet rays below about 330 mu. The ultra violet rays between 330 and 290 mu. are probably the best pigment-producing rays; however, because of their absorption by window glass, it becomes difficult to tan behind such glass. Snow, ice, water and sand increase ultra violet intensity by reflection.

PHOTOCHEMICAL EFFECTS

Red and infra red rays produce an immediate hyperemia which, however, soon disappears after the cessation of the irradiation. Infra red rays, it has been shown, are more likely to produce cutaneous blisters in animals. The visible rays provoke vision, heat and metabolic

changes; however, the visible red or heat rays are able to elevate subcutaneous temperature as much as 3 degrees C.

Ultra violet rays are rapidly absorbed, in most part, by tissues at a depth of approximately only 1 or 2 millimeters and produce marked chemical and actinic changes in accord with Grotthus law, namely, that only those rays that are absorbed can produce chemical changes. The hemoglobin quickly absorbs ultra violet rays as well as many of those of longer wave lengths up to approximately 450 mu. Blood serum absorbs the ultra violet rays chiefly because of its tyrosin and tryptophan content.

EFFECT OF ULTRA VIOLET ENERGY UPON PROTOPLASM

The Brownian movement of collodial particles quickly ceases on exposure to ultra violet rays. Egg and serum-globulin are precipitated at the expense of albumin. Lens albumin previously sensitized by certain salts such as calcium, sodium and magnesium, silicates or dextrose becomes sensitive to ultra violet radiation. Bacteria are rapidly destroyed by these rays of wave length less than 302 mu; the bactericidal effect at times becoming more marked as the wave length decreases. Temperature elevation increases this destructive action, and changes in the hydrogen in concentration appear also to play a role. The blood cells *in vitro* are quickly hemolyzed, perhaps because of the destruction of their lipoidal membrane. This, however, does not occur *in vivo*. Protoplasm may be so affected by ultra violet rays as to become especially sensitive to heat radiations. The visible manifestations of tissue hyperemia due to ultra violet radiation occur only after the lapse of a certain latent period, two hours or more. On repeated exposures, a product melanin is formed in the basal cells of the epidermis; this may be due to the action of certain skin oxidases on a breakdown product of tyrosin.

Unicellular organisms are stimulated to certain physiological changes such as fission, or they may be destroyed by ultra violet radiation, depending on such factors as the intensity of irradiation, its penetrative power and the size of the

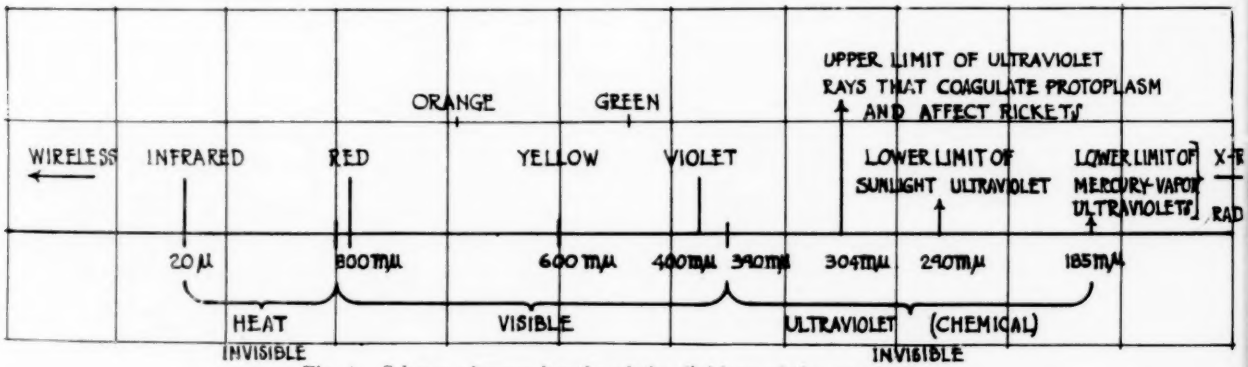

Fig. 1. Scheme of wave lengths of the divisions of the spectrum.
μ=Micron—.001 Millimeter.
Mμ=Millimicron—.000001 Millimeter.
A=Angstrom Unit—.0000001 Millimeter.

organism. Thus, very short ultra violet rays have been shown to affect only the cytoplasm, whereas longer ultra violet rays may reach the cell nucleus. Small doses of light appear to have a stimulating action, while large doses produce deferred physiological changes and still larger doses may destroy unicellular organisms. Cholesterol, a substance found in comparatively large quantities in the epidermis of the skin, is activated chemically by ultra violet irradiation. This has been shown to be so by isolating cholesterol and rendering it antirachitic by irradiation with ultra violet rays. It becomes endowed with antirachitic power in some unknown way by absorbing the ultra violet energy from the light source.

Many food products, such as milk, vegetables, lettuce, etc., may also become endowed with antirachitic power by exposing them to sources of ultra violet energy. How this actually takes place is still a matter of speculation; our knowledge of the exact nature of radiation itself is so limited that its effects on tissues or food products becomes doubly difficult to understand.

PHYSIOLOGICAL ACTION OF LIGHT

The increased calcium and phosphorus content of the blood serum in rickets and tetany under ultra violet radiation has been mentioned. This is due in all probability to an increased absorption of calcium from the intestines. Under solar radiations the blood shows increased alkalinity, a fact attributed to the action of the heat rays.

Light exposures alone do not induce changes in red blood cells and hemoglobin, except of a very transitory character, and this chiefly when a pre-existing anemia occurs. Lymphocytosis in rabbits and possibly in man can be produced by exposure to the shorter ultra violet rays. Cell membranes have been shown to have increased permeability on exposure to these short rays. Animals kept in darkness from birth show growth changes differing in no way from those exposed to light, but blood examinations show lowered blood platelets. On exposure of these animals to mercury-quartz vapor radiations, the number of platelets rapidly increased to normal.

Basal metabolism is increased little if at all by light exposures alone, but this can be markedly increased by exposure to cool moving air and salt water baths. Increased heat output by radiation under a provoked hyperemia demands increased metabolism. Under light exposures, respiration is decreased in rate, but increased in depth. Increased body heat production obviously demands accelerated vital reactions. The rate of growth may possibly be increased under the action of light.

The increased physiological action of the skin under light exposures may be presumed, namely increased respiratory, excretory and protective powers. It is rare to find acne developing in tanned skin. During an epidemic of chicken pox

at Rolliers clinic, no cutaneous vesicles were found on tanned skin, whereas they did appear on unexposed areas beneath plaster casts. Hyperemia of the skin produced either by heat or chemical radiations is accompanied by increased bacteriophagic and bacteriolytic power of the blood serum for streptococci or staphylococci. From an apparently lifeless, toneless and flabby skin, light exposures often produce a soft, velvety, colorful tissue. Under exposures to solar radiations and to artificial sources of light, remarkable muscular tonus has been produced in unused muscles, despite prolonged application of immobilizing casts.

The action of light on the body is in all probability largely an indirect one by way of the cutaneous nerves and blood vessels. Shorter ultra violet rays for the most part are absorbed by the epidermis; however, deeper penetration of the longer visible rays may allow of some slight direct deep action (about 5 cm.) but there is little cause to believe that this can be of much direct therapeutic value. Heat rays and heat effects of luminous rays may increase and hasten the effect of ultra violet energy, but when using minimal doses of ultra violet, red rays have been shown to act antagonistically.

DOSAGE

The curative results in light therapy may be brought about without producing marked cutaneous erythema or burn, and only the first degree of redness need be produced with light baths. The skin offers a vast field of living cells, which are exposed to stimulation or injury in many ways, and such effect seems to provoke immunizing and protective powers. *Excessive damage to the skin from light may be harmful;* a small amount of irritation stimulating and useful.

The dosage of light to be used therapeutically cannot be a fixed one. The sources of light and the individuals irradiated vary too greatly to allow of any generalization as to dosage. Some workers prefer an erythema, and others strongly stress the desirability of the production of pigment. The Copenhagen School employing particularly the carbon arc light, prefer erythema, whereas Rollier stresses pigment. That increased pigment production necessarily means an increased tendency to healing is not generally accepted. However, similarly, the

Fig. 2.—Filling defect in the large colon.

production of an erythema is not a necessary accompaniment of improvement. Pigment absorbs heat and may possibly sensitize the skin to visible light as chlorophyl does the plant. At this time there exists no proof for this theory. *Patients that failed to pigment have clinically responded favorably to treatment just as patients who strongly pigmented often failed to heal clinically.*

LIGHT AND MOVING AIR FROM THE OUTDOORS

Light application necessarily requires consideration of moving or open air. The latter necessarily accompanies exposures. With lamps moving air from outdoors should always be employed, if possible. Air movement produces increased heat radiation and conduction with better respiration and excretory function of the skin. Moving air acts directly upon the vasomotor system, stimulating the superficial capillaries, producing a hyperemia, and in turn a depletion of the cutaneous circulation. This, acting as a massage, may be responsible for the development of muscles, otherwise immobilized in treatment. With sunlight therapy, the effect of moving open air is probably greater, but air exposures may well be utilized with artificial light therapy through satisfactory ventilation of the treatment room. Carbon arc lamps may be effectively used out-of-doors in warm weather. However, chilling should always be avoided even at the expense of losing the air movement when one is employing artificial sources of light.

SUNLIGHT VERSUS ARTIFICIAL LIGHT

Enthusiasts for solar therapy have insisted on the use of radiation having a spectrum exactly like that of sunlight. There is no other ground for this, than that the clinical results with solar exposures have been most favorable in the hands of these workers. There is no empirical evidence and some theoretical basis for expecting satisfactory therapeutic results with other combinations of light rays. We may logically reason that certain forms of tuberculosis, especially the superficial, are more responsive to greater intensity of short wave ultra violet radiation than exists in sunlight itself. Empirically, this has been noted by us in the use of the mercury-quartz light.

Sunlight is composed of about 1 to 2 per cent ultra violet rays, 30 to 40 per cent visible, and 60 per cent infra red rays; its total energy in long ultra violets, according to some workers, surpasses that of the mercury-quartz light. The quartz-mercury vapor light possesses a preponderance of the short and long ultra violet rays, as well as the blue, indigo and violet rays, and some energy in the red, but considerably more in the green waves. The carbon arc emits wave lengths similar to those of sunlight with great intensity of the infra red and longer ultra violet rays. The total ultra violet energy of sunlight about equals that of the mercury-quartz light.

Sunlight possesses the additional advantage of moving outdoor air, and the

favorable pyschic reaction which accompanies the ease, comfort and relaxation of solar exposures. With lamps, the available light energy is constantly at hand and the dosage is more easily controlled. The carbon arc of very low amperage is of little clinical value; those of high amperage and especially those employing thin carbons are most effective. The carbons may be plain or impregnated with special metallic cores, such as titanium, aluminium, tungsten, etc. Groups of low amperage carbon arc lamps are often used for irradiation of bed-ridden patients; high amperage lamps are as a rule used chiefly for ambulant patients. The cost of installation and the operation charges of large carbon arcs and the necessary care makes them valuable chiefly for the handling of groups of subjects. Mercury-quartz lamps are either of the air-cooled type for general body irradiations or of the water-cooled type for local application, particularly when combined with special quartz applicators. The life of the carbon arc lamp is indefinite so long as the carbons are replaced. The life of a mercury-quartz burner is about 1,500 to 2,000 hours of interrupted use. The quartz burners may then easily be replaced.

Pigment produced by carbon arcs of high amperage resembles that formed by solar exposures.

Quartz-mercury arcs produce a pigmentation, but its color is usually a duller brown as compared with the red brown of sunlight. *At times we have observed mercury-quartz lights produce a pigment barely distinguishable from that produced by sunlight,* but it is much less lasting. Pigment produced by intense sources of heat such as oxyacetylene blasts or osram lights closely simulates sunlight tan, and is said to be just as permanent. The function of pigment is not clearly known so that its production or the lack of it offers no indication for clinical usage of light.

Indications for the use of various sources of light therapy are still inexact, as also are the contraindications, but it is certain that in the cold seasons of the

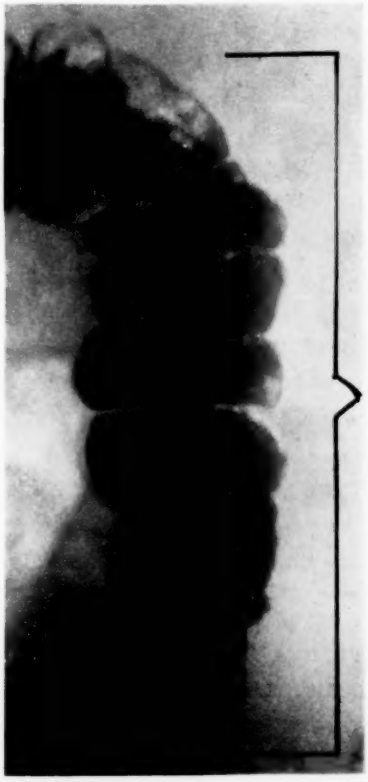

Fig. 3.—Same case as in figure 2 taken some time later, with almost complete absence of the filling defect.

year, when solar exposures are impossible or in localities where sunlight is uncertain in intensity and duration, artificial sources of light have proved most valuable substitutes.

With sunlight the patients are graduated to increasing periods of exposures over larger areas of the body, according to Rollier's technique. Sunlight of the lowlands and highlands is equally valuable, but the heat of the day should be avoided. Diffuse daylight and air exposures on cloudy days are used with great advantage. Chilling winds should be avoided. Over-exposure may incite focal reactions to activity.

With carbon arcs one begins with a fifteen-minute irradiation, front and back, and then increases daily fifteen minutes front and back until exposures of two and one-half hours daily are made. The lamps are placed at a distance from the patient so that the heat emitted from this source of light is tolerable. Frequently sweating occurs during the exposures. The treatment is then terminated with a sponge bath. General body exposures are always employed, and if possible, an additional local exposure is made. In all cases as much of the skin surface as possible, is irradiated.

With mercury-quartz light, exposures have been made by us purely on an empirical basis, beginning with three minutes at a distance of 36 inches from the body, employing two exposures in front and two behind, centering over the middle of the upper and lower halves of the body in order to expose uniformly as much of the skin surface as possible; a fifth exposure is then made directly over the area of disease to include any possible reflex depth action; a daily increase of one minute is added to the exposure until a twenty-minute period is reached, front and back, at this distance on all five parts. The room temperature is maintained at about 70 degrees F. Ventilation is employed so that the patient senses the movement of air. Heat lights are added, if the patient is not able to endure the ventilation without discomfort.

The quartz lamp is then slowly brought nearer to the body by lowering it about one inch every other day until it is 18 inches from the skin. After this, the second intensity is employed; this, however, is not always necessary. In addition to the general body exposures with the air-cooled mercury-quartz light, a contact exposure is often made to a superficial focus of tuberculosis by means of an applicator attached to the water-cooled mercury-quartz light.

An overdose of light may set up a focal reaction similar to that of tuberculin. Therefore, it seems advisable at all times rather to underdose the patient. Some English workers add only one minute weekly instead of one minute daily to the duration of exposures.

Other artificial sources of light are frequently employed abroad, such as the tungsten arc, the cadmium arc, oxyactylene flames, osram lights, etc.

The schedule for increasing the period of exposures with various sources of light is not a fixed one. The doctor must be guided chiefly by the signs and symptoms evinced by the patients in their response to treatment as well as by the study of skin reactions. The selection of a form of light therapy may depend upon the state of activity of the tuberculosis to be treated or upon the form of tuberculosis; thus, with a febrile advanced case one would generally prefer to avoid the heat rays. One may also have to depend upon the source of light available or be influenced by the season of the year, etc. Furthermore, a failure in response to one form of light therapy may be an indication for the trial of another form, or possibly many forms of light therapy may have to be combined in various ways. The intensity of the mercury-quartz light varies so markedly from time to time that one should frequently measure it before application. There are certain simple tests with photo-sensitive papers which serve as rough guides for estimating intensity; these may be satisfactorily employed in most cases. We have found that some patients of sallow complexion showed little skin erythema on first exposure to the mercury-quartz lamp, but reacted later to this if previously treated with three to four doses of the carbon arc lamp. There may exist contraindications to light therapy which are not yet clearly understood, but which later with more experience may become evident.

It is highly probable that in most forms of progressive acute tuberculosis light therapy is not indicated. The one exception to this rule seems to be that of intestinal tuberculosis. In this form of tuberculosis it has been empirically determined that ultra violet light therapy is of great value.

With any form of tuberculosis, light is used merely as an adjuvant and should be combined with every other possible aid. The mainstays of treatment still exist in rest, good food and hygienic outdoor life.

With bone and joint tuberculosis, orthopedic treatment with immobilization, traction, etc., is absolutely essential while employing light exposure. Surgical interference is occasionally needed, especially for aspiration of abscesses or for hastening expulsion of sequestra. Joint resection and anchylosis is much less often necessary with heliotherapy, but there may even yet be certain social, economic and other factors that occasionally force this intervention. The plaster cast is less often needed. As pointed out earlier *one always combines general and local light exposures regardless of the location of the lesion.*

CLINICAL RESULTS

Sunlight: The most favorable responses to solar exposures have been shown by: The so-called pretuberculosis of children, hilum, lymphnode, pleural, bone and joint, peritoneal, and early intestinal tuberculosis.

Less favorable results are usually obtained in pulmonary, genito-urinary laryngeal, ocular, aural and cutaneous tuberculosis. With joint tuberculosis the fibrous form of anchylosis has been overcome and joint function was often restored. With lymph-node disease, massive tuberculous glands have been extruded from their capsules during healing by light.

Carbon Arc: With arcs of high amperage (55 to 75 amperes) or with multiple arcs of 20 to 25 amperes, the best results have been reported with cutaneous, bone and joint, lymph-node, laryngeal, peritoneal and ocular, (corneal and phlyctenular) tuberculosis; less favorable has been the response of pulmonary, genito-urinary and intestinal tuberculosis.

Mercury-Quartz Light: In our own experience of nine years with the use of the mercury-quartz light as an adjuvant, the most favorable response has been encountered in intestinal tuberculosis. The diagnosis is established by a history of all forms of digestive complaints such as alternating constipation and diarrhoea, nausea, vomiting, abdominal pain, soft or watery stools, or merely by persistent loss of weight or slight elevation of temperature otherwise unexplained—by any or all of these symptoms combined with x ray demonstration of spasm or filling defect in the caecum or ascending colon. Plates 4 and 5 show x rays of the intestine with a filling defect before treatment and an almost complete disappearance of this after eight months of quartz-mercury exposures; accompanying this was a cessation of digestive complaints. After the study of a large series of such cases of which the foregoing is typical, we are convinced that this recovery is directly related to the light therapy.

Other forms of tuberculosis which in our experience are frequently responsive to quartz light exposures are the so-called hilum or "hidden" tuberculosis of children and adults; superficial forms of tuberculosis, such as the cutaneous, oral or pharyngeal, laryngeal (except the acute and the rapid edematous forms), corneal and phlyctenular ocular tuberculosis, lymph-node and peritoneal tuberculosis. Less favorable in their response but occasionally improved are genito-urinary, and bone and joint tuberculosis.

Reliance upon light as an important aid in pulmonary tuberculosis is not to be encouraged.

IN CONCLUSION

Light of any form by itself is not curative, but comprises only one of our important adjuvants in the treatment of tuberculosis. To believe that sunlight or artificial sources of light will cure all forms of "surgical" tuberculosis, to be unduly optimistic about this therapy and consider it a specific form of treatment; to use it without sound medical guidance and adequate equipment; and finally, to employ it to the exclusion of rest and the hygienic-dietetic regime and eliminate orthopedic measures or occasional necessary surgical intervention in bone and joint tuberculosis is bound eventually to dishearten many sufferers and bring discredit upon an otherwise eminently desirable method of treatment.

ACTINOTHERAPY

PATHOLOGY: NEUROLOGY

ULTRAVIOLET LIGHT IN THE MANAGEMENT OF THE NEUROPATHIC CHILD*

I. L. SHERRY, M. D.,
Instructor in Pediatrics, University of Illinois College of Medicine,
Chicago

NERVOUS instability is characteristic of early childhood when the system is in its developmental state, and minimal stimuli normally produce maximal reactions. Born with an unstable nervous system into an environment which is constantly producing excessive stimuli, the neuropathic child develops—"a product of heredity and environment."[1]

He is the spoiled child, the child who is hard to handle. He is irritable, cries readily, often timid and easily frightened. He may be mentally bright, even precocious, but lacks concentration. He is often animated and full of restless energy. Yet he tires easily and constantly complains of fatigue. He has an unstable vasomotor system, suffering frequently from cold hands and feet. The pulse is rapid and easily further increased by the least excitement.

Insomnia is a frequent complaint, or the sleep is disturbed by night terrors. Chvostek's sign is often easily elicited. Chorea is a common sequela of infections in these children. Masturbation or nocturnal eneuresis, or both are often present.

The neuropathic child is usually poorly nourished and anaemic. His appetite is invariably poor. He is habitually constipated, except for occasional attacks of diarrhea which are not usually of enteric origin. Urticaria, eczema, asthma are not of infrequent occurrence.

This symptom-complex occurs, in whole or in part, in such a large percentage of children in the pre-school age, that the neuropathic, or more popularly termed, the nervous child must be recognized as a distinct clinical entity. More than one-half of the children from 2 to 6 years of age coming to the pediatrician's office can be placed in this group. Some of these children are fairly well-nourished and of good color, but the majority are anaemic, under weight and listless.

They all present practically the same list of complaints, viz, anorexia, especially for the foods that they should eat, failure to gain, constipation, irritability, and disturbed sleep at night. Many of these children are very susceptible to changes of weather; they contract colds frequently. They seem to have little resistance to infection. Some give a his-

*Read by title at the fifth annual meeting at Chicago, October 20, 1926.

tory of cyclic vomiting. Most of them vomit easily at any time, especially on such occasions as when foods are forced in an attempt to make them gain, or when medicines are given to improve the appetite, or correct the anaemia, or overcome the obstinate constipation. Eneuresis, thumb-sucking, masturbation, are common complaints. Many of these children have, at some time or other, manifested symptoms of spasmophilia or even tetany.

In infancy the neuropathic child has been what is known as a difficult feeder, not in the sense that he suffered from lack of appetite or anorexia, but because he had frequent gastro-intestinal upsets. He was a colicky baby; he cried a great deal; he regurgitated copiously after feedings or even displayed symptoms of true plyorospasm. Constipation was a prominent feature in the syndrome. Spasmophilia was not unusual. Eczema was frequently present.

This type of infant as a rule did not remain long on the breast, because the mother, as a result of her difficulites, was readily convinced that her milk did not agree with the baby. Following the early institution of artificial feeding, and because the prophylactic administration of cod liver oil was usually impossible, rickets, to a greater or lesser degree, almost invariably developed. These infants can not or just won't take cod liver oil.

Weaning from the breast may have been easy, but weaning this type of child from the bottle is always difficult. Thus, the addition of solid food to the diet is always attended by trials and tribulation. Even at 3 and 4 years of age, we find many of these children still addicted to the bottle.

The management of the nervous or neuropathic child is one of the most difficult problems in pediatrics. The term "management" is here used advisedly, for treatment, in the sense of administration of drugs, plays a very minor part in the attempt at cure. To the child in whom nervous irritability and restlessness may be especially acute, bromides might be administered for a short while. In some cases, the anaemia might be improved by a course of arsenic and iron. In other cases, it might be possible to administer cod liver oil over a long enough period to secure some increase in appetite and a gain in weight. Further than this, drugs are of little use.

A change of environment is often fruitful of excellent results, but this is rarely possible, for economic reasons. Much can be done, however, in improving conditions at home. An unusual amount of tact and common sense is necessary in the home care of the nervous child. In most cases the lack of appetite is more a matter of habit than anything else. Such a child expects to be coaxed or coerced into eating his food. He thus develops a negativistic attitude and doesn't eat. Often he consumes an excessive quantity of milk, and naturally has appetite for little else. Especially is

this true in those children with whom bottle feeding has been prolonged. These errors in training must be corrected.

Where there are physical defects, such as carious teeth, hypertrophied or rather infected tonsils and adenoids, improvement will often follow their correction. A proper daily regime should be mapped out for hours of sleep, rest and play. A sufficient amount of fresh air and sunshine is indispensable. It is said that the well-tanned child is usually a happy child.[2] The sun's rays seem to stimulate the physiological processes of growth and development to normal activity. In children below par physically and mentally, ultra violet irradiation produces marked systemic improvement.[3] The appetite is increased, the sleep is better, and the disposition of the child is generally improved. J. Bell Ferguson of England[7] in a recent volume on "The Quartz Mercury-Vapor Lamp," speaks with enthusiasm of the effects of ultra violet radiations upon children suffering from malnutrition, simple digestive disturbances, fretfulness, nervous irritability, inadequate increase of weight for no definite reason, babies who do not seem to thrive. After the first three or four treatments, the children are more alert, and more contented. Mothers report better nights and quieter sleep.

Physicians who have charge of large numbers of nervous patients, as in insane asylums, have found that regular exposure of these patients to sunlight renders them more manageable.[2] Whenever heliotherapy is employed in tuberculosis sanitaria, the soothing effects of the light, and the allaying of nervous symptoms in the patients is one of the most noticeable results of the treatment. Russell[3] states that ultra violet radiations act the same way as sunlight in producing a feeling of mental exhiliration and cheerfulness, and a sense of well-being.

The physiological mechanism whereby the rays produce these clinical effects is a matter which has given rise to considerable speculation. The sympathetic nervous system which has a wide distribution in the skin, among other functions, controls the glands of internal secretion, including the parathyroids.[4] It is known that the chief function of the parathyroid glands is the regulation of the calcium metabolism in the body. Gates[5] produced enlargement of the parathyroids in rabbits by irradiation of these animals. This suggests the mechanism whereby the ultra violet rays effect their specific action in rickets, spasmophilia and tetany. In the latter condition, calcium deficiency is the direct etiological factor, and no doubt this is also the case in other degrees of nervous instability in children. By the specific action of ultraviolet rays upon the calcium metabolism, we may explain the mechanism of their sedative effect in nervous instability.

We must also consider the fact that one of the constituents of the brain and other nervous tissues, in fact, of all ani-

mal cells, is cholesterol. Cholesterol and the similar constituent of all plant cells, phytosterol, have been shown to have a marked affinity for ultra violet rays. Hess[8] has shown that it is the irradiated cholesterol in animal tissues, and the phytosterol in vegetable tissues, which are antirachitic. Children and laboratory animals fed on irradiated food stuffs containing these ingredients failed to get rickets, or were cured of the disease if already suffering from it.

Phosphorous is also an important constituent of nervous as well as other tissues of the body. The inorganic phosphates in the blood have been repeatedly shown to be increased by ultra violet irradiation. The specificity of ultra violet light for rickets and spasmophilia is due to the increase in calcium and inorganic phosphate of the blood serum produced by irradiation. In the neuropathic or nervous child there is usually some degree of rickets and spasmophilia. At any rate there is always a disturbed calcium metabolism in all cases of nervous instability.

Anaemia is a marked symptom in most of these neuropathic children. Ultra violet irradiation is superior to iron or arsenic in producing an increase in hemoglobin and red cells. Russell[3] irradiated a patient daily for twenty-three days, making frequent notes of the pulse, systolic blood pressure, number of red and white cells per cubic millimeter. The hemoglobin rose from 70 to 90 per cent and the red cells increased from 4,300,000 to 5,725,000. Ferguson[7] states that the red blood cells and hemoglobin increase after continued ultra violet irradiation. Many other workers have reported the cure of secondary anaemia with ultra violet radiations. I have repeatedly checked the changes in hemoglobin and red cells in private patients receiving ultra violet treatment and found in most cases a noticeable increase in both of these constituents of the blood.

Associated with the easy fatigue and listlessness in many of these neuropathic children, there is a poor tissue turgor and lowered muscular tone. Flabbiness of the muscles is quite noticeable in most of these cases. Ultra violet radiation has a markedly beneficial effect upon the muscle tone. Rollier[9] calls attention to the remarkable development of the back muscles in patients cured of Pott's disease by immobilization and continued exposure to the sun's rays. Artificial ultra violet light brings about the same results in much less time than is required by sunlight.[4]

Thus, with improvement of environmental conditions as far as possible, correction of faults in training and methods of feeding, removal of physical defects such as carious teeth, hypertrophied tonsils and adenoids, and other foci of infection, ultra violet radiation will be found an excellent adjuvant in the treatment. There is a further point to be considered in the use of ultra violet light in the management of the neuropathic child, which is rather of practical importance. Regular exposures to ultra violet radiations requires regular visits

to the doctor's office for a considerable length of time. The psychological effect upon both mother and child of this regular and continued observation by the attending physician plays a large part in the successful management of the case. This form of treatment not infrequently makes it possible to keep these patients under the proper regime of diet and training for months after all treatment would otherwise be abandoned.

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30 N. Michigan Ave.

BLADDER TUMORS AS TREATED BY THERMO-ELECTRIC COAGULATION*

B. C. Corbus, M. D.

Chicago, Ill.

The subject of bladder tumors has received serious consideration during the last ten years, most particularly by American urologists, and the reason for this has been the discouraging results in the treatment of tumors that originate in the bladder.

Lower said as recently as four years ago that "the most discouraging outstanding field in urological surgery was the destruction and cure of neoplasms of the bladder." He said "except for the benign papilloma that were treated by what he called fulguration, our results were discouraging." During the last three years there have appeared from some of our foremost American surgical clinics excellent papers in regard to the treatment of bladder tumors by excision. All these groups of surgeons recommend thorough and wide excision of the cancerous tissue.

In 1901, Dr. Kolischer, before the American Urological Association, demonstrated as far as I know the first patient in this country suffering from neoplasm of the bladder treated by diathermy. Dr. Kolischer has been most kind in his instruction and help to any of the young urologists who attempted this work. I want to thank him for the interest that caused to be stimulated in this work in the beginning. Doyen, the French surgeon, says that we are surprised often after surgical excision of the cancer to see recurrence in the wound and often metastases to the regional glands. He says that the knife acts as a veritable stroke of the whip, that it disseminates cancer whenever it is used, and compares it to pollen before a gust of wind, saying that it is scattered to all the surrounding tissues.

Of all the physical means of destroying pathological tissue, heat is the most efficient. In destruction of the cancer cell, we must bear in mind that the neoplastic cell is easier destroyed by any destructive agent than any other cell, and it is this one thing that dominates the whole handling of cancer by heat. Rosenberg says the most efficacious of all the methods of destroying cancer is heat, either from without or occurring as a result of fever.

Of 200 cases of 'correctly correlated cancer that disappeared spontaneously, heat was present in every instance, either induced by infection or occurring as a result of pneumonias, tuberculosis, etc. Heat will cure cancer if you can get it high enough.

*Read at fourth annual meeting American College of Physical Therapy, October 20, 1925.

Jansen has placed the vulnerability of the cancer cells at 116 degrees Fahrenheit for five minutes, and Loeb the vulnerability of sarcoma at 113 degrees Fahrenheit for thirty minutes, and the normal cell will stand a temperature of 130 to 140 degrees without being destroyed.

A great deal of credit is due to Dr. J. F. Percy, of Illinois, in his advocation of heat in the destruction of cancer. He has gone all over the country year after year preaching that excision of cancer is a mistake and that heat applied, especially with his method, is efficacious.

The principle is the soundest that we ever have had given to us up to the present time in the destruction of cancer. During the last year or year and a half, those of you who follow the literature know what the trend in the treatment of cancer has been. We know that basal-cell carcinoma responds more quickly to diathermy or endothermy than any other method, with less scarring effect.

Widal noticed in some of his cases with cancer that developed fever that there was a recession of the tumor growth, and he conceived the idea of experimenting on dogs. He tied off their heat zone and the temperature of these dogs arose to around 104, and the cancer gradually receded.

If we could give our patients a high enough temperature, it probably would have a very beneficial result in destruction of the cancer, but, of course, we know to induce in the body a high degree of temperature for any length of time is disastrous.

The subject of bladder tumors is interesting because up until the time that the American urologists began to attack these tumors, the condition was considered, as a rule, fatal. Tumors of the bladder occur, as a rule, in about 90 per cent of the cases on the floor of the bladder. They occur on the trigone, or very close to the ureteral openings, and if we find them early in the form of papillomas. We know that all carcinomas of the bladder have their incipiency in a papilloma, and if you leave the papilloma long enough, it will pass from a benign growth to a malignancy, and it will have all the degrees of malignancy that you want to find as described by the pathologists at the Mayo Clinic. You can find the most benign and most malignant tumors, all of them having their origin in the papilloma of the bladder.

The cardinal symptom of a bladder tumor is hemorrhage. Hemorrhage is the thing that first makes its appearance. In 98 per cent of the cases hemorrhage is the first thing that calls our attention to the tumor of the bladder. How often we see a patient come into the office and tell the doctor that he has had a hemorrhage of the bladder, and the doctor says, "Well, I don't think that amounts to very much. I'll give you a little medicine." The patient goes away, satisfied that he has had a little hemorrhage and

has had a little medicine for it and that is all he needs.

These papillomas bleed; they bleed after exercise or after some exertion, and if the patient remains quiet, frequently they do not bleed for a good many years, sometimes for six months, sometimes they come on more frequently. The time that a bladder tumor can be best attacked and when our results can be most perfect is at the time of the first hemorrhage. *When a patient comes to a doctor with a hemorrhage from the bladder, that case needs cystoscopic investigation to see why the hemorrhage occurred.*

How very much concerned we are if one of our patients has a hemoptysis! We immediately tell him he may have tuberculosis and he must be taken care of. How little importance is placed on hemorrhage from the uterus or hemorrhage from the rectum. All these conditions mean something is present that should not be.

Among other symptoms that we have in conjunction with tumors of the bladder is pain, pain on urination, frequency of urination, and tenesmus. Oftentimes these are the predominating symptoms, and we must not lose sight of the fact that cancer is no respector of age. We have had a carcinoma of the bladder in a young boy as early as 26 years of age. We must not lose track of the one thing that we must do if we wish to be successful in the treatment of bladder tumors—*all cases of hemorrhage of the bladder must be investigated.*

What is our mode of treatment in bladder tumors? The practice that we have adopted (there are others who do not agree with us, and some who do) is that where we have a bladder tumor that we believe to be papillomatous in character and it is easily accessible, we prefer to attempt to destroy this tumor by transurethral coagulation, that is by means of an operative cystoscope and a diathermy apparatus.

Where the tumor is easily accessible, localized, and there are not too many of them, a trial should be made at the destruction of the tumor by transurethral method.

When the tumor is benign, you can burn it down just the same as you burn a wart down, and if you burn it severely enough that is the end of it; that is the reason Beer's method of treating his papillomata of the bladder was successful, and that is the reason Nietze used the hot wire and was more successful in his time than any previous person. If the tumor is benign, it is easy to see how you can totally destroy it by escharring it, by burning it up. But if the tumor has any malignant tendencies or is malignant, the surface destruction of the tumor will not permit the penetration of the heat.

In using diathermy, I wish to emphasize that we utilize the heat effects of diathermy and not the escharring or destroying effects that we get from a current.

With respect to our method of anesthesia, if we are going to operate at

nine o'clock in the morning, we give a 1/6 of a grain of morphin and 1/150 of scopolamin at half past six; at half past seven we repeat the same, and at half past eight we repeat it again, always taking great care to keep the patient as quiet as possible and away from noises, away from anything that would disturb him in the sleep that we are trying to induce.

After a patient has been duly anesthetized with scopolamin-morphin anesthesia and we may be sure of the condition of the bladder by previous cystoscopic examination, an incision is made suprapubically under local anesthesia, through the muscles into the bladder, doing a cystotomy. A retractor is put in the bladder and the active electrode is placed down over the tumor. Previously we have our inactive electrode placed under the patient's buttocks, and between the electrode and the patient's skin we have large pad moistened with hypertonic salt solution. It is a very necessary thing in carrying out long coagulation, to see that this pad is kept wet with solution in order not to burn the patient's buttocks. Our idea is to have a direct extension of the heat from the active electrode down through the tissues to the inactive electrode, when the tumor is situated on the floor of the bladder.

The question of the depth of burning has been brought up. We place our finger in the vagina in the female and in the rectum in the male, and get the electrode right over the tumor that is situated on the base of the bladder. When the heat becomes so hot that the glove finger cannot tolerate it, we withdraw the finger and for the time being shut off the current. After the parts have cooled down, we insert the finger again and apply the heat again.

Our method of coagulating these tumors is somewhat different from that which other surgeons are using in diathermy for the destruction of bladder tumors. We believe it is not necessary to carbonize or to spark, but our idea is that we should slowly heat the tumor to a point that we know is sufficient to destroy the cancer tissue, not only heating the tumor, but going sufficiently outside the tumor to insure destruction of any cancerous tissue. We coagulate this tumor until it has a parboiled effect. I take that expression from Percy. This parboiled effect of the tissues gives us a complete coagulation of all the tumor mass. Where we have tumors situated laterally on the bladder wall, up near the vertex, we push back the peritoneum and put our finger between the bladder on the one side and the electrode on the other side, so no matter what place we are treating these tumors in the bladder, we have our finger as a guide in regard to the amount of heat tolerance. We have no satisfactory way of measuring it. We have tried different ways of putting thermometers in here, but they are not satisfactory, so we have found that the best method of applying surgical diathermy

is to use our finger as an index and a guide to the amount of heat that is applied.

Many times the tumors, as I have said before, occur on or near the ureteral openings. Some surgeons have devised methods of transplanting the ureter in different parts of the bladder where the ostium is involved in carcinoma. You can readily see that this ureter travels for quite a distance through the bladder muscle. It comes through in a diagonal way, and you can easily see how the ureter can be burned back a considerable distance and not destroy the ureteral opening.

This procedure was hit upon entirely by accident, after a severe and extensive coagulation of a bladder tumor we looked into the bladder and found the ureter; we had burned considerably backward and pulled over on the side, so at no time do we pay any attention to the involvement of the ureteral opening when the cancer is near it or on it. We simply burn with diathermy down on the tumor, irrespective of whether the opening is there or not. Quite frequently we have had, following this burning of the ureter, a temporary pyelitis with obstruction to the kidney on that side, and in several instances following the burn we have had extensive sclerosis following this method making it necessary to incise the ureteral opening. We pay absolutely no attention any more to the localization of the tumor on the bladder floor, irrespective of the ureteral opening; we destroy it by coagulation.

Following our coagulation, it has been our practice to sew in the bladder a catheter, sewing the bladder up as tightly around the catheter as we can, then closing each layer, bladder, muscle, and then skin, and after the suggestion of Eisendrath we put in fine rubber drains between each layer and take them out in forty-eight hours. Following that procedure we get primary union.

In the application of diathermy to bladder tumors we have the advantage that following the coagulation there is very little hemorrhage; we have a sealing of the lymphatics, we have a coagulation all around the tumor, the nerve sensation is diminished, and we have following this operation practically no shock at all. So far as the procedure goes, following the diathermy the patient is infinitely better off than he is after extensive surgical excision.

At the present time we have treated 31 bladder tumors, and in the 31 bladder tumors my associate and I have had four deaths. I think those statistics are as good as anybody has had up to the present time. We are not fooling ourselves with the idea that we are not going to lose some more of these cases. We will, but up to the present time we have that group of cases with only four deaths. The oldest patient that we have is alive and well, and has been well seven years.

I cannot but believe that excision in the treatment of tumors is a mistake. We often see cancers occurring in the breast, on the lip, the tongue, and the first thing

the surgeon wants to do is to take a piece out for biopsy. I believe great care should be taken in taking a piece for biopsy. Often in excision cancer cells are absolutely disseminated, and what we might do later is absolutely futile. If tissue is to be taken for diagnosis, it should be taken with a cautery; if not, it should be immediately followed by some form of electrical coagulation. If it were not for metastasis, cancer would not amount to anything. It is the metastasis of cancer that bothers us.

Fortunately for us as urologists cancer of the bladder metastasizes very infrequently. For a long time it stays localized, and it is this fact, plus an early diagnosis, that is going to make us successful in our attack on the cancer cell in the bladder with heat.

DISCUSSION

DR. GUSTAVE KOLISCHER (Chicago): I firmy believe that Dr. Corbus' work and his paper are of very far-reaching importance. In the first place, this helps to prove (and I hope it will help to convince the profession at large) that the knife has played its role so far as malignant tumors of the bladder are concerned.

If you take all the statistics together, those of the enthusiasts, the people who fool themselves and fool the medical profession, those who tell the truth, and the pessimists, you will find that the results of the knife applied to malignant tumors of the bladder are very, very bad. There is a mortality of about 40 per cent in the best clinics. Patients by the hundreds are killed by surgical intervention. Relapses almost invariably follow on very short order, and the relapse is as bad as the original trouble, frequently. Even if we succeed in keeping a patient alive for some length of time after the dissection of the bladder wall, the capacity of the bladder is so reduced that the patient did not gain very much. Be that the patient did not gain very much. Benight's rest. There are very few cases where even a total extirpation of the bladder gave a permanent result. As far as I know, there is only one case that lived fifteen years after the operation.

There is nothing new to resections of the bladder. They were tried years and years ago. always with the same results, so quite a number of experienced urologists and general surgeons decided not to tackle the bladder tumors at all any more.

The coagulation of malignant tumors has changed entirely. I should like to go a little further than Dr. Corbus as to the influence of heat. We know that heat alone is not always successful. We know about twenty years ago, before Percy started this extirpation, Mackenrodt suggested and performed this operation to extirpate the cancerous uterus, attempting to prove that by the radiation of heat the cancer cells were destroyed. That has been proven entirely erroneous. After a cancerous uterus was extirpated, it was shown that there were just as many cancer cells as before; they had not been touched at all.

That was finally given up for another reason. If we used a solder iron and burned to any extent, the patient was exposed to the danger of secondary infection. That is all avoided by diathermy. The products of decay do not enter the circulation, providing the operation is properly done.

Corbus mentioned the slow cooking of the tumor, which I think is one of the most important features in the technique. We discard entirely the fulguration of the surface of the tumor, which we used in former years, because we were afraid of implanting parts of the tumor somewhere else in the bladder mucosa.

The use of showering sparks under the high pressure that is necessary in these cases is really a danger to the patient. We slow up our current, we drop the current. The old method we have discarded and do entirely now as Corbus suggested.

The influence of heat and the undoubted advantage of taking cancers by heat may be based on another thing. It is now a general belief of roentgenologists and radiologists that whatever we accomplish by radiotherapy (and it is immaterial whether our rays emanate from a radioactive substance or an x ray tube) is mainly due to the influence on the general system. It is not so much the direct destruction as the reduction of the zone of action in which the cells may produce certain bacteria which enter the circulation and may stimulate the endocrin glands, which finally leads to the disappearance of the abnormal function of tissue, which, in fact, is the conception of a malignant tumor. It is proved by experimental work that if we coagulate the tumor, beyond the zone of necrosis there is a zone which we call the diathermic zone of activation.

The only way to handle a malignant bladder tumor is by diathermy, by slow coagulation, as Corbus suggested. It is not the ideal method, but the primary mortality is low, probably around 10 per cent, which is pretty good in cancer. If we succeed, the capacity of the bladder is not reduced at all, and so far as we can tell now, about 75 per cent of the cases remain well. It is not ideal, but at the present time it is the best we have to offer, and we can recommend it with a clear conscience.

Dr. F. L. Nelson (Ottumwa, Iowa): I have been raised on the surgical principles of this work, going back probably ten years ago in New York City among the urologists, where some very beautiful work was done on bladder resections, transplantation of ureters, and all those things. It looks very nice, but the results you all know.

We began to do some cautery work through the cystoscope. In Bellevue especially, this was not very successful, and in the department there it was rather frowned upon and looked upon with disfavor, although Beer at that time was still doing his work. Since that time there has been, as you know, a sort of division between the therapeutists and the surgeons. If you are a surgeon you stand up for one, and if you are a therapeutist you stand up for the other. That is why I want to say, first, that I have been raised on the surgical side, and being a real convert, so to speak, of the therapeutic side, I feel that I can speak a little more freely.

In the last two or three years I have been doing the work entirely with surgical diathermy. My work corresponds exactly to Dr. Corbus.' This is the first time I have seen him or have had the pleasure of meeting him, but I am glad to say that our work is very closely related.

Tomorrow I shall have the pleasure of giving a paper on the same thing, and showing quite a number of patients that have been operated on by surgical diathermy suprapubically, some of them dating back over two years. The object is to show what that method will do. Some of those cases were in very bad condition.

I do not care to go into that discussion right now, but I do say this is a field that must be recognized. If you know the work and have really gotten into it and know how to do it, you will find many points of what we call fine technique that I am afraid many have overlooked. Dr. Corbus especially brought them out, and I should like to speak on them further. It cannot be a hit-and-miss proposition. It reminds me of what Dr. Deaver of Philadelphia said one time—"Well, the Lord must have held an umbrella over them." There is too much of that in some of this work. We rely too much on chance sometimes.

Dr. Corbus is to be congratulated on his work. Dr. Kolischer, needless to say, requires no com-

mendation on his work. The men who worked out this thing in the beginning did not have the encouragement that we have now, for instance, in doing that work and following it up.

DR. REX SHOLL (St. Petersburg, Fla.): Some probably know that Dr. Kelly at Howard A. Kelly Hospital has discarded the knife entirely now. I spent two months there, and Dr. Kelly and Dr. Ward are doing the same work now in bladder tumors that Dr. Corbus is doing. Dr. Ward said at Johns Hopkins one time that all the surgeons who were doing surgery had better come into the fold, because this was the greatest thing that had ever been done.

DR. B. C. CORBUS: I want to thank the gentlemen for their discussion of this subject.

Do not hesitate to do a second cystotomy in an extensive coagulation, if necessary, but the idea is if possible to finish the job up the first time and do it as thoroughly as it can be done. The scar tissue that follows is the greatest thing we have, because it certainly is nature's method of producing protection by coagulation and stopping the spread of cancerous cells.

We have had no deaths on the table or the next day following the use of surgical diathermy. Most of the deaths occur as urinary sepsis; they occur where you have coagulated both ureters and you have produced a temporary obstruction of the ureters. Those are the things that have happened to us. In no instance, in all the times we have burned bladder tumors, have we burned either in the vagina or in the rectum. But we have had deaths following the blocking off of the ureter. It is probable that these kidneys were damaged before any surgical diathermy was used.

All these cases that come under observation and come to the operating table for the destruction of tumors should be studied and cared for just the same as any other urological cases. Blood chemistry should be attended to beforehand, and if we have our patient already in extreme condition, it would be very foolish to try coagulating the tumor when we know we are going to kill the patient.

WHAT IS DIATHERHY AND HOW DOES IT ACT ON TISSUE?*

ALBERT F. TYLER, B. Sc., M. D., F. A. C. P.

Omaha

THE fact that the program committee of your organization asked me to present a paper on the subject of surgical diathermy, is sufficient proof in itself, of the interest you men have in this newer method of surgical procedure.

Since not all may be familiar with the history of the development of this method in surgery, it seems to me that it would be interesting for us to touch that phase briefly.

SYNONYMS

The term *diathermy* was first introduced by Nagelschmidt, following the presentation of a paper at the Buda-Pesth Congress in 1908. At that time he showed a special apparatus for heating the tissues through, or as the German term used by him, *durch warmung*. The term *diathermy* has become most generally used and is the commonly accepted term employed in describing the application of the high frequency current to the human body. Other terms have been devised by other men, however, among those being *epithermy, transthermy* and the most recent one *endothermy* suggested by George Wyeth of New York. In spite of these suggestions, the term *diathermy* seems to stick, consequently we are using it today in this discussion.

*Read by invitation at annual meeting Midwestern Section of the American Laryngological, Rhinological and Otological Society, Omaha, Feb. 11, 1926.

As stated a moment ago, diathermy is really the application of the high frequency current to tissue. The high frequency electrical current is the same type of current as is commonly used today in the production of the radio. Technically it is an alternating type of current which is very rapidly reversed in its polarity. Many machines used today give as many as one million reversals of the current per second. It was shown by d'Arsonval, Professor of the College de France, Paris, in 1908, that when this type of current is passed through the human body, muscle contraction is felt up to about 5,000 interruptions per second. At 5,000 interruptions the muscle contraction becomes very feeble and when 10,000 have been reached, disappears, so that today the modern machine for producing diathermy is built to produce more than 10,000 interruptions per second. The voltage needs to be only sufficient to carry the current through the tissues of the thickest part of the human body. The amperage is scarcely ever more than three.

HISTORY

The use of the high frequency current in medicine was first suggested by the American engineer, Nikola Tesla, in 1891, his first report being found in the December number of the *Electrical Engineer* of that year. In 1898 d'Arsonval

began his experimentation leading up to the conclusion cited above.

In 1907, Nagelschmidt, a Berlin Physician, began applying this type of current to the human body and found that it was very valuable in the production of heat within the tissue, and recommended its use in the treatment of diseases of the joints and circulatory system. In February, 1908, Berndt and Von Zeyneck published a paper on the treatment of joint diseases by high frequency current. In 1909 the high frequency current was introduced into England by Lewis Jones, late medical officer to the Electrical Department of St. Bartholomew's Hospital, and has been steadily advanced by his successor, Elkin P. Cumberbatch. On October 21st, 1910, Nagelschmidt, as an invited guest, demonstrated the use of diathermy in three surgical cases at St. Bartholomew's Hospital. This was the first use of surgical diathermy in England. Surgical diathermy was employed in the United States during the years 1903 and 1904 by Finley R. Cook of New York City, who used the "high frequency current extensively in a surgical and a very satisfactory manner in treating papillomata, nevi, keloids, scar tissue, enlarged tonsils, hemorrhoids, and as a dipilatory agent" (Med. Record, Dec. 21, 1907). Since that time, the employment of this current in medicine has become well nigh universal. It has been greatly stimulated since the World War. Due to the fact, I think, that during the war, group practice was made necessary so that large numbers of physicians were so situated that they were compelled to see the effects and advantages of using physical measures in medicine.

MEDICAL DIATHERMY

As already suggested by some of the pioneers in the use of this current, it is put to two main purposes, one—the use of it in a medical way. That is, where it is desired to heat the tissues below the point of destruction. This method is found of great value in the treatment of arthritis, especially of the gonorrheal type, and of lobar pneumonia as introduced by Harry E. Stewart. In the latter case it is practically a specific and when used immediately after the diagnosis is made, has, in almost every instance, aborted the disease, reducing the temperature to nearly normal within a forty-eight-hour period, making the patient comfortable and thus avoiding the long toxic period where the disease is allowed to run its normal course.

SURGICAL DIATHERMY

Today, however, we wish to speak more particularly about the so-called surgical use of diathermy. The surgical use is employed wherever it is desired to destroy tissue. Immediately there will come to your mind many concrete illustrations of conditions where this current can be used to advantage. It has several advantages over other methods of treatment in certain conditions. One of these is the fact that it has such a delicate regulation. The slightest amount of current can be used for destroying a

small benign skin lesion or sufficient current can be used to destroy growths that are very vascular and consequently inoperable by ordinary surgical procedure. Blood vessels measuring one centimeter in diameter can be destroyed by this current without shedding a drop of blood. Any growth to be suitable for this kind of treatment must be accessible, that is, it must be on the surface of the body or in some of the body cavities, such as rectum, vagina, nose, throat or mouth. Very frequently diathermy can be used as an adjunct to ordinary surgical procedure destroying cells along the wall of the blood vessels that cannot be satisfactorily removed by the knife.

From this brief description you will readily realize that any amount of heat can be generated by this current. The interesting thing about it is that the heat is generated in the tissue itself. This gives it a tremendous advantage over other forms of application of heat. You will notice in the pieces of muscle which I have already passed about the room, the difference in the effect on the tissue by the actual cautery and treatment by diathermy. Where the red hot iron is used, either in the form of a soldering iron or Paquelin Cautery, the heat radiates from the hot iron itself. The heat is much more intense adjacent to the iron and is rapidly diminished as the distance is increased away from the iron. This means that immediately surrounding the heated iron there will form an area of carbonized tissue. Carbon is very resistent to the penetration of heat and thus shuts off the heat from the iron confining its destructive effects to one or two millimeters on each side of the iron. On the other hand when diathermy is used the heat is generated in the tissue. One should be careful not to use enough current to char the tissue but to go more slowly and allow the tissue to be coagulated. The effect on the tissue is similar to the effect of heat, as illustrated in the boiling of an egg. The tissue becomes grayish white in color. Moisture is driven off in the form of steam. The tissue is drier than normal and is completely devascularized. When the whole mass has been coagulated in this manner, the coagulated mass can be removed with a curette or scissors, as far as possible without producing bleeding. By following the coagulation by removal of the mass, much time is conserved in repair and secondary infection is much less apt to occur. The method of applying high frequency current to produce this effect is important. One can place one electrode on either side of a portion of the tumor, allowing the current to flow through until that mass is completely cooked and then move to another area and so proceed until the entire mass has been equally coagulated. Other men prefer to place a large indifferent electrode on some distant part of the body, using a small active electrode to go over the tumor itself.

RADIO KNIFE

More recently there has been introduced into the surgical world, a different type of tissue destruction commonly

called the *radio knife*. This is a knife-like electrode attached to an instrument similar to the sending apparatus of a radio. In this particular type the current comes to the electrode undamped and the frequency is so great that the tissues practically explode when the electrode is applied against them and drawn slowly across them. By keeping the electrode moving the tissue can be separated without coagulating them sufficiently to prevent primary union. For removal of a breast or some similar procedure, this type of radio knife is very beneficial since the wound can be closed and will heal by primary union. This instrument, however, is not applicable where one wishes to coagulate large masses of tissue, so that the ordinary diathermy machine is much more suitable for the routine work of an office or institution. Percy brought to our attention, several years ago, the value of using slow heat in destroying carcinoma of the uterus. He demonstrated by both experimental and clinical data that through the employment of a temperature insufficient to char tissue a much wider penetration could be obtained. His apparatus employed radiated heat.

Surgical diathermy produces the same coagulation of tissue but more rapidly and throughout a wider radius because the heat is generated in the tissue itself instead of being radiated to the tissues. The electrodes employed in surgical diathermy are always cold and do not become hot even while in use.

EFFECT ON TISSUE

When tissue, which has been coagulated with the high frequency current, is examined under the microscope it appears as a conglomerate mass without structural identity. The cell walls and nuclei have disappeared and the tissues do not take the stains well. The passage of the high frequency current through the tissues produces heat, steam, nitrous fumes, ozone, ionization and liberates electrons and electro-magnetic waves. All of these processes combined render the tissue lifeless and fragile. The coagulated mass is sterile when the work has been completed, but offers a fertile field for secondary infection. It is advisable, therefore, to remove as much of the coagulated mass as possible at once and to keep the wound clean by the usual surgical procedures applicable after operation.

EVALUATION OF SHADOWS SEEN IN THE DENTAL X RAY PICTURE*

WILLIAM A. LURIE, M. D.

New Orleans, La.

THE study of the dental roentgenogram lends itself admirably to the classification of shadows both from the differences in their optical capacity and as an index of the tissues or substances penetrated or portrayed. In such pictures, three classes, or well defined grades of shadow can be differentiated. These classes of shadow can also be definitely described and used as an index or coefficient of the resistance to penetration which they individually picture. Advantage can be taken of any change in opacity or grade of shadow which is pictured, both as an indication of a variation in penetrability and as an indication of what pathological change has taken place. This latter possibility precludes a knowledge of the anatomical arrangement of the tissue in the area pictured, with a knowledge of the different areas of variation in tissue density which appears as a physiologic or pathologic histological arrangement of the parts. After the mastering of these fundamental details in the reading of the pictures, a value can be placed upon the appearance of the shadow of any grade in an abnormal position. Such an evaluation becomes an index of the pathology which is pictured.

First it is necessary to consider the x ray film as an index of actinic ray penetration. Penetration is that one particular force of the x ray which is invaluable in this instance. Without actinic force penetration no picture would be possible. (1) The roentgenogram, x ray picture, or radiogram is in reality a penetogram. The index or registration of actinic force penetration as produced by the roentgen rays. As greater force action produces greater silver salt reduction it produces greater film opacity, and it, therefore, is a direct registration of that force. As the actinic force of an x ray picture is a registration of residual force, after an area is penetrated by the rays we, therefore, have a record of such penetration. This record as an index of resistance, however, is in inverse ration to the intensity of its registration. That is to say, that the greater the opacity, the lesser the resistance and the lesser the opacity the greater the resistance, so that opacity is the direct index of force and the indirect registration of resistance.

We shall make this application later.

The dental penetogram (2) lends itself nicely to the study of shadow grade, for the two important anatomical shadow values can thereon be so nicely and clearly pictured, and the abnormal distribution of any of these tissue grades

*Received for publicatin March 22, 1926.

can be more easily detected. The third grade of shadow is found so often in the dental areas as a replacement for reparation of lost tissue, that its distribution under certain conditions may be looked upon as normal and in others as abnormal or the significance of pathology.

Anatomically tissue is soft or muscular and lightly resistant, and hard or bony and more greatly resistant. The treating of muscular and bone tissue to the action of heat or caustic substances leaves residues of different characters. For volume, the ash of the one over the other will vary in the percentage and the numbers of different salts. Likewise the residues after acid treatment will be found to differ in the salt content in the different tissues. Chemically and physically these two grades of normal tissue vary. Their salt content, as to the ratio of its deposit is the greatest variation so that it is possible to say that the amount of some salts in one tissue is negligible when compared to the amount of the same salts in the other. As an index to be portrayed, the resistance offered by the salts found in soft tissue when compared to the lighter gaseous elements in that tissue is very small. The inorganic salt content is also very little when compared to the amount of these salts in bony tissue. It is almost such that a line can be drawn between the names of a list of all elements, salts and minerals, listed according to their atomic weight so that this list will be divided into three distinct sections. In the first section there are the gases and light mineral salts. These predominate in muscular and soft tissue to resist penetration. In the second section there are a distinct group of the heavier mineral salts which are found in greater ratio in bony tissue and lastly heavy mineral salts and metals.

Refer to Table.

To make an accurate mathematical deduction would require the work and time of an analytical chemist and expert mathametician, but such absolute correctness is not essential. Suffice it to know that in soft tissue the animal matter contains a lesser proportion of salts of heavier mineral base than there is to be found in the bony structure and that in the bony structure the animal matter is in such small proportion that as a registration of a difference in penetration it can be disregarded. There is no animal matter in the materials used as fillings or the metal in the making of restorations, so they can be considered as a direct index of substances of such atomic weights as they are composed of.

While atomic weight is not governed by density, x ray penetration is, so the comparison of masses of elements to paper is made in the Service Suggestions of the Victor X Ray Corporation of August, 1921, and reference is made to the table of findings. It is interesting to note that if the atomic weight of the average of the elements found in different tissues is multiplied by the average density, that number will approximate the percentage of silver reduction and opacity

THE ELEMENTS IN THE ORDER OF ATOMIC NUMBERS

International atomic weights for 1918, O 16. The international atomic weights are fixed yearly by an international committee of chemists.

Atomic No.	Atomic Weight O =16	Element	Symbol	Atomic No.	Atomic Weight O =16	Element	Symbol
1	1.008	Hydrogen	H	44	101.7	Ruthenium	Ru
2	4.00	Helium	He	45	102.9	Rhodium	Rh
3	6.94	Lithium	Li	46	106.7	Palladium	Pd
4	9.1	Beryllium (Glucinum)	Be	47	107.88	Silver	Ag
				48	112.40	Cadmium	Cd
5	11.0	Boron	B	49	114.8	Indium	In
6	12.005	Carbon	C	50	118.7	Tin	Sn
7	14.01	Nitrogen	N	51	120.2	Antimony	Sb
8	16.00	Oxygen	O	52	127.5	Tellurium	Te
9	19.0	Fluorine	F	53	126.92	Iodine	I
10	20.2	Neon	Ne	54	130.2	Xenon	Xe
11	23.00	Sodium	Na	55	132.81	Caesium	Cs
12	24.32	Magnesium	Mg	56	137.37	Barium	Ba
13	27.1	Aluminium	Al	57	139.0	Lanthanum	La
14	28.3	Silicon	Si	58	140.25	Cerium	Ce
15	31.04	Phosphorus	P	59	140.9	Praseodymium	Pr
16	32.06	Sulphur	S	60	144.3	Neodymium	Nd
17	35.46	Chlorine	Cl	62	150.4	Samarium	Sa
18	39.88	Argon	A	63	152.0	Europium	Eu
19	39.10	Potassium	K	64	157.3	Gadolinium	Gd
20	40.07	Calcium	Ca	65	159.2	Terbium	Tb
21	44.1	Scandium	Sc	66	162.5	Dysprosium	Dy
22	48.1	Titanium	Ti	67	163.5	Holmium	Ho
23	51.0	Vanadium	V	68	167.7	Erbium	Er
24	52.0	Chromium	Cr	69	168.5	Thulium	Tm
25	54.93	Manganese	Mn	70	173.5	Ytterbium (Neo. Yb)	Yb
26	55.84	Iron	Fe				
27	58.97	Cobalt	Co	71	175.0	Lutecium	Lu
28	58.68	Nickel	Ni	73	181.5	Tantalum	Ta
29	63.57	Copper	Cu	74	184.0	Tungsten	W
30	65.37	Zinc	Zu	76	190.9	Osmium	Os
31	69.9	Gallium	Ga	77	193.1	Iridium	Ir
32	72.5	Germanium	Ge	78	195.2	Platinum	Pt
33	74.96	Arsenic	As	79	197.2	Gold	Au
34	79.2	Selenium	Se	80	200.6	Mercury	Hg
35	79.92	Bromine	Br	81	204.0	Thallium	Tl
36	82.92	Krypton	Kr	82	207.20	Lead	Pb
37	85.45	Rubidium	Rb	83	208.0	Bismuth	Bi
38	87.63	Strontium	Sr	86	222	Radium Emanation (Niton)	Nt
39	88.7	Yttrium	Y				
40	90.6	Zirconium	Zr	88	226.0	Radium	Ra
41	93.1	Niobium (Columbium)	Nb	90	232.4	Thorium	Th
				92	238.2	Uranium	U
42	96.0	Mylybdenum	Mo				

ATOMIC WEIGHTS AND DENSITIES OF THE ELEMENTS

Element	Atomic Weight	Density	Element	Atomic Weight	Density	Element	Atomic Weight	Density
Al	27	2.70	He	4	0.178*	Rb	85	1.532
Sb	120	6.62	H	1	0.08987*	Ru	102	12.3
A	40	1.78*	In	115	7.12	Sa	150	7.8
As	75	5.73	I	127	4.95	Sc	44	—
Ba	137	3.75	Ir	193	22.41	Se	79	4.5
Be	9	1.93	Fe	56	7.86	Si	28	2.3
Bi	208	9.80	Kr	83	3.708*	Ag	108	10.5
B	11	2.5 ?	La	139	6.12	Na	23	0.971
Br	80	3.10	Pb	207	11.37	Sr	88	2.54
Cd	112	8.64	Li	7	0.534	S	32	2.07
Cs	133	1.87	Lu	175	—	Ta	181	16.6
Ca	40	1.55	Mg	24	1.74	Te	127	6.25
C			Mn	55	7.39	Tb	159	—
Diamond		3.52	Hg	201	13.56	Tl	204	11.9
Graphite	12	2.3	Mo	96	10.0	Th	232	11.3
GasCrbn		1.9	Nd	144	6.96	Tm	168	—
Ce	140	6.92	Ne	20	0.9002 *	Sn	119	7.29
Cl	35	3.23*	Ni	59	8.9	Ti	48	4.50
Cr	52	6.50	Nb	93	12.75	W	184	18.8
Co	59	8.6	N	14	1.2507*	U	238	18.7
Cu	64	8.93	Os	191	22.5	V	51	5.5
Dy	162	—	O	16	1.429*	Xe	130	5.851*
Er	168	4.77?	Pd	107	11.4	Yb	174	—
Eu	152	—	P	31	2.2	Y	89	3.8?
F	19	1.69*	Pt	195	21.5	Zn	65	7.1
Gd	157	—	K	39	0.862	Zr	91	4.15
Ga	70	5.95	Pr	141	6.48			
Ge	72	5.47	Ra	226	?	Paper	—	1.0
Au	197	19.32	Rh	103	12.44			

*Grms. per litre at 0°C. and 760 mm.

(1) "The Neglected Phases of Dental Roentgenology." *William A. Lurie*, M. D. The International Journal of Orthodontia and Oral Surgery. Vol. VII, No. 11, November, 1921.

(2) "Penetology," *William A. Lurie, M. D.*, New Orleans, La Dental Summary 1922.

1130 Maison Blanche Bldg., New Orleans, La.

of a film in the inverse ratio. That is to say, the number representing heaviest salt in soft tissue as represented by the opaque shadow will not be greater than 70. The same process for the average of salts in bony tissue will show that number to be about 450, while almost any mineral salt other than found normally in the tissues will be found to produce a value greater than 700 and most often approaching 2,000 and more. These numbers represent a distinct amount of resistance the different salts offer. Such differences are appreciable and can be distinguished roentgenographically.

Penetration is the force registered. Actinic ray registers force penetration. The x ray picture is a registration of that force, then why not call it penetogram? (A registration of actinic force that has penetrated.)

There are two other factors which must be taken into consideration in the study of the opacity of shadows as a measure of light force and they are the incidents of speed and time of exposure. Numerically these should be equal on any one film and particularly on the dental film, they are so nearly equal over

Fig. 1.—The three teeth illustrated represent the resistance to penetration of x ray in a normal, or untreated tooth, a tooth subjected to heat to destroy and remove the animal matter, and a tooth given an acid bath to dissolve out the mineral salts. Note the difference in the resistance coefficient as expressed in shadow value of shade variation. In tooth I there is a root canal filling visible. Tooth II was heated white hot and note how it changed its form because of the loss of animal matter. Much of the dentine and the crown of the tooth occupied by the pulp chamber, which is in great proportion soft tissue, has burned away. The root has changed shape correspondingly and for the same reason. The root canal is pictured. Tooth III was a gelatinous mass when pictured after an acid bath. Note from this shadow that the general shape of the tooth is retained. The heavier shadow in this tooth is some root canal filling material which was unaffected by the acid bath. The numerals are portions of metal. This is a positive print and the reverse in color from the negative, which is the most often read for diagnosis.

Figs. 2, 3, and 4—A comparison of the different grades of shadow as pictured, indicates if their position and relation or ratio of resistant areas of grade I and grade II coefficient composing alveolar bone shadow is disturbed. At some points in alveolar tissue shadow the ratio is in favor of grade I coefficient and at another there is more of grade II resistance pictured. Grade III resistance can be particularly noted to be in abnormal positions as an overhanging margin on a filling, as bismuth paste in the alveolar process and as a piece of broken needle which is becoming encysted.

the entire area that a difference is incalculable. As a unit, speed and time may be considered as 1,000. The consideration of tissue resistance as related to the time and speed unit gives us a percentage of resistance. It will be found that these percentages are fairly accurately the index of opacity in the inverse ratio. Thus, for soft tissue, an average resistance of 7 per cent to 93 per cent of opacity can be looked for. Bone represents a resistance up to 45 per cent and 65 per cent opacity can be registered, while mineral salts and metals register up to 100 per cent resistance and nil in opacity.

To describe the various grades of shadow, grade I, which represents soft tissue which has no small and loose salt content, will be found represented as a heavy smooth shadow of great opacity. A representation of 93 per cent reduction of silver. The representation of a resistance coefficient of 7. A pathological condition within this tissue or grade of shadow is difficult of detection for it is a disturbance in the normal salt content arrangement. This change must take place within a possible 7 per cent registration of force. This is almost impossible of differentiation. It is only when such a process reaches the stage of pus formation, where gases are formed and where salts are precipitated that it is more possible of being pictured. (This commentary concerns dental areas only.) The later pathological changes in soft tissue is the organization of the pathological process which means a greater content of salts which increases the resistance. If these salts are in great enough proportion that shadow area has an increased resistance coefficient which may even approximate that of bone or be greater than 7 per cent.

A combination of grade I shadow and grade II in a definite anatomical relation forms the picture of alveolar bone. It is the picturing of small areas of a resistance coefficient of 7 per cent surrounded by thin shadow of bone densities or shadow value resistance of about 45 per cent. This is in representation of the cell and canal arrangement known as the Haversian system in alveolar or medulary bone. Alveolar bone, therefore, is an anatomical mixture of definite character of soft and bony tissue. This arrangement can be pictured by a difference in the registration of penetration, and is pictured distinctly different than either soft tissue or denser bone. This definite mixture and arrangement in shadow is easily distinguished. It presents a mottled appearance, in distinction to the appearance of shadow of grade I. This is also true in distinction to grade IIb. It is a division of bone tissue and bone shadow; therefore, it falls into grade II, yet this character of shadow is of two classes, alveolar and dense. Grade II shadow is therefore divided into a and b classes: (1) Grade IIa to represent alveolar bone and (2) grade IIb the heavier or denser bone as represented in the dental penetograms as teeth and the bone about promontories and about ridges of the jaw bones.

Pathological processes in alveolar tissue either alter the soft tissue content by an increase or decrease in their propositions. The bony walls of cells and canals in the picture are either increased or decreased in thickness. It is the ratio of the one over the other that is recognized. It is the substitution of a resistance coefficient either greater or lesser than normal which indicates the pathological process which has taken place. If there is less opacity than the coefficient of resistance should indicate, there has been less penetration and an increase in the heavier salt content. In an area of alveolar bone shadow this would indicate a condensing ostitis or a new bone formation, whereas the reverse, a greater opacity with the indication of a lesser coefficient of resistance would be interpreted as loss of bone density and an increase in the soft tissue ratio. A breaking down of tissue, or as is known as abscess formation or a destructive process of the abscessing type.

Grade IIb is principally represented on the dental penetogram in shadow of teeth. In this structure the salt content is very compact and little or no animal matter pictured within the outline of their structure, except as is in a definite area as the soft tissue in the pulp chamber and root canal. In its relation of resistances of grade IIa and grade IIb shadows, grade IIa pictures more frequent and smaller areas of grade I shadow, without their having a continuous or typical relation to the bone shadow, grade II, whereas grade IIb is a representation of greater or larger areas of grade II resistance with definite and typical areas of grade I within them and surrounding them. As teeth, pathology is represented by changes in the typical shadow resistance value which character typically delineates a tooth. As the chief pathological condition is decay, it will be the only process described in this relation.

Tooth decay is a breaking away of the mineral content of the tooth substance and an increase in animal tissue and in instances its replacement by vegetable matter. The great difference in the resistance coefficient of these different grades of tissue is demonstrable. It becomes apparent in the finding of some portion of tooth shadow which should be pictured as grade IIb, replaced in grade I shadow. Such replacement is an accurate indication of the extent of decay. This is so true that it is possible to say in the study of any of the shadow grades described that they can be taken to represent anatomical areas with exactness. With the position, size and surrounding of any area or shadow representing an anatomical part recognized through its coefficient of resistance, the change or alteration in such outlined areas of the resistance predominent for that area indicates a change, histological or pathological.

Any increase of the resistance in soft tissue coefficient is pictured by a lessened opacity. Changes in alveolar tissue alters the normal ratio of grade I and grade II resistances as pictured. The resistance

may be decreased or increased, dependent on the process pictured. In grade IIb tissue, decay is pictured by a decreased resistance in the area it represents. An increase in the opacity, making a spot, of 93 per cent opacity in an area which should be entirely pictured as an area of 65 per cent opacity.

Consider grade III shadow. It embraces all the materials used in replacing decayed and lost parts of teeth or missing teeth. Except for porcelain and some porcelain cements, all these materials are mineral salts and metals, greatly compacted. Their coefficient of resistance is high, their film opacity low. Their pathological significance is only in relation to the position they may be discovered in, in relation to other shadows. As a root canal filling which completely replaces the soft tissue in this area, it should have a definite and exact extent; likewise as a material replacing decay in tooth substance, it has an exact position and extent. Any variation of these extents constitutes the imperfection of the position of this material, and constitutes an abnormal or pathological situation.

To describe all possible combinations and alterations which could be considered as either a normal or an abnormal picturing of the dental areas would take several chapters of an extensive work on this subject, so these few changes have been selected to indicate the possibility of reading histological changes through the classification of shadows and the reading of their pictured opacities as a coefficient of the resistances they represent. The pictured opacity is an index of the resistance to the penetration of the actinic force of the x ray and therefore may be considered a registration of that force which has penetrated, so why not a penetogram?

EDITORIAL

ARCHIVES OF PHYSICAL THERAPY, X-RAY, RADIUM

A Journal of Ideas and Ideals.

A. R. HOLLENDER, M. D., Editor

ALBERT F. TYLER, M. D., Managing Editor

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PHYSICAL THERAPY IN AMERICA AND ABROAD.

The younger physicians can not realize and the older physicians hardly remember that twenty-five or thirty years ago there did not exist in medical life the words x ray, ultra violet, diathermy, electrotherapy or all those modern advancements of physical therapy. If you look at this wonderful and splendid meeting we are attending here and have been attending for the last few days, and which we hope to attend for some more days, and if you consider the difference of the standing of physical therapy at the end of the last century and the development today, you can hardly understand how in a small space of a few years, about thirty years, such enormous development could take place. It is only explainable by the fast time in which we are living. Technic, science, civilization, all that fills out our life, are developing at such a tremendous rate of speed and in such a short space of time that it is not to be wondered that medicine has to follow this speed.

If we look abroad and look back for thirty years we must remember that this development was not easy to reach; tremendous struggles have been fought out on the old continent. I remember very well how great a struggle I had to make against the school of medicine. No one would recognize those new methods. It was very hard to introduce them. It caused a lot of work, slowly building up the work to prove to the school of medicine that physical therapy really meant more, something of value, something new and of real advancement to medical science and practice.

So we can admire all those fine speeches and interesting discussions which we have been able to assist hereto,

and I hope that the next days of the Congress will show just as good work and just as much advancement as the first days did.

Let me tell you a few words about physical therapy abroad. In Europe, I may say that France, Belgium and Austria are the countries where physical therapy has reached the highest degree, not in the way of developing new methods or in the way of delivering especially worthy papers and works and publications, but these three countries are the only ones I know of where the official universities take account of physical therapy. Small universities like Ghent, near Brussels, have physical therapeutic departments which are absolutely modern. You will find everything there from the sand bags and the medical mechanical treatment to the highest perfection of x ray and light therapy.

I must state that Germany is far behind. I have not been able to induce our universities to erect a teaching school or a teaching place for physical therapy. It is true that nearly all universities have departments, but they are incomplete, and there is no official chair for teaching physiotherapy. I am astonished that America seems to be the same.

The standing of the single developments of these physical therapeutical methods may be equal, it may be that in some regards the older countries are a little farther advanced and in other regards America is farther advanced; especially I admire your beautiful research institutions. We do not have such institutions in Germany at all. I think they are wonderful and it must be a pleasure to work in them because you have everything, you have the theoretical arrangement, you have the physical outfitting and you have the material of patients and laboratories and everything you like. This I find is a very great advancement, and we are very much handicapped in not possessing institutions like that.

In hydrotherapy, for instance, I think Germany is more advanced. I think the first hydrotherapy came from England, but it was developed mostly in Germany. I don't know why in America hydrotherapy isn't farther advanced or why it isn't in a higher degree, but it may be that it is too dry.

FRANZ NAGELSCHMIDT.

ANNUAL MEETING

The fifth annual meeting of the *American College of Physical Therapy* "went off with a bang" to quote numerous physicians who attended.

Dr. Hollender arranged a program of wide variety covering the various phases of physical therapy. The first two days were devoted to instruction classes, the teachers being chosen from research men, college professors and clinicians. The men appeared on schedule time with every hour filled from eight in the morning to eleven in the evening.

The next two days' program was divided into three sections, Medicine and Endocrinology, Surgery and Gynecology, and Eye, Ear, Nose, Throat and Oral Surgery. Each section was crowded. Friday was devoted to a joint session of all sections. Saturday was given over entirely to clinics at the various hospitals. So eager were the men to attend these clinics that standing room was at a premium and many were unable to gain admission.

The evening sessions were especially interesting with one evening devoted to the subject of teaching physical therapy, another to the relation of physical therapy to the State Medical Society to the American Medical Association and other medical organizations. On this evening Dr. Mundt, president-elect of the Illinois State Medical Association, presented the viewpoint of that organization, while Dr. Harry E. Mock, Chairman of the Council of Physical Therapy of the American Medical Association, touched upon the work of the Council as related to the *American College of Physical Therapy*.

Very fortunate indeed were the men who heard Dr. Franz Nagelschmidt of Berlin. Known as the "Father of Diathermy," he proved a willing worker and a valuable addition to the program. He gave six lectures on the regular program besides a happy and witty after dinner speech at the annual banquet.

Physicians were registered from Peru to Calgary and from Maine to California. More than 1,000 were in attendance. Everyone seemed more than satisfied with the material presented and the arrangement of the program.

The commercial exhibits were large, covering several thousand square feet of floor space and representing every phase of x ray and physical therapy equipment. A.F.T.

OFFICERS

The following officers of the *American College of Physical Therapy* were elected to serve during the coming year:

Disraeli Kobak, M. D., Chicago, President.

J. C. Elsom, M. D., University of Wisconsin, President Elect.

F. H. Walke, M. D., Shreveport, La., First Vice President.

Norman E. Titus, M. D., New York City, Second Vice President.

J. U. Giesy, M. D., Salt Lake City, Third Vice President.

F. J. Novak, Jr., M. D., Chicago, Fourth Vice President.

Roy W. Fouts, M. D., Omaha, Secretary.

John Stanley Coulter, M. D., Chicago, Treasurer.

DR. KOBAK HONORED

Our President, Dr. Disraeli Kobak, has recently been appointed Associate Professor of Medicine, in charge of Physical Therapy at Chicago University Medical School. Thus another

great university has provided for the teaching of physical therapy to undergraduate medical students and at the same time has recognized the qualifications of a leader in this phase of medicine. A.F.T.

MONTHLY PHYSIOTHERAPEUTIC LECTURE CLINIC

Monday, December 13th, 1926.

"Diathermy in Treatment of Gonococcal Infections of the Male," 10:00 to 11:00 a. m., E. B. PERRY, M. D., Chicago, Illinois.

"Diathermy in the Practice of the General Surgeon," 11:00 to 12:00 a. m., CARL M. BARNES, M. D., Chicago, Ill.

"Diathermy in Treatment of Bladder Tumors," 1:30 to 2:30 p. m., E. B. PERRY, M. D.

"Treatment of Tuberculosis with Ultra Violet Light," 2:30 to 3:30 p. m., H. H. REDFIELD, M. D., Chicago, Ill.

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GUY BARTLETT
Schenectady, N. Y.

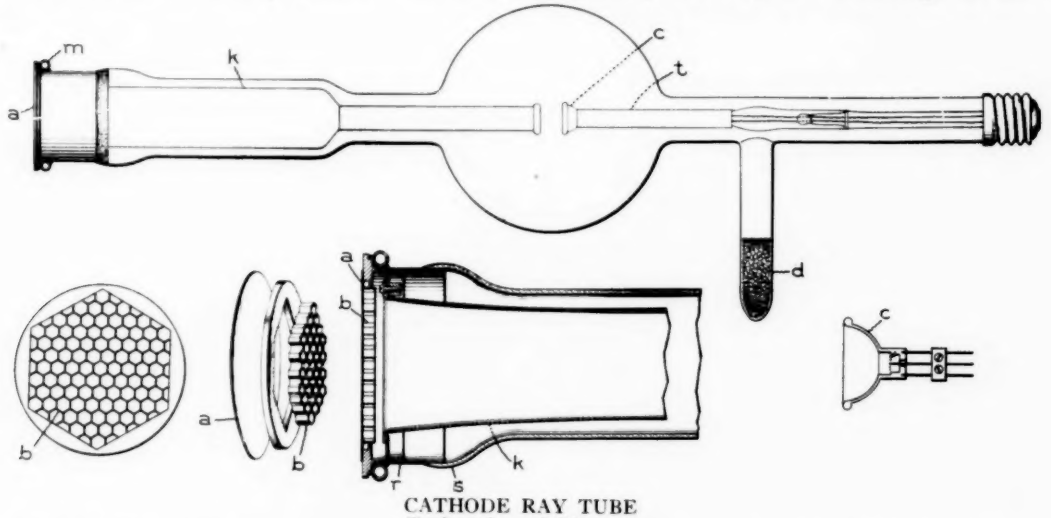
A vacuum tube which produces as many electrons per second as a ton of radium—and there is only a pound of that rare substance in the world—was announced by Dr. W. D. Coolidge of the research laboratory of the General Electric Company at a meeting of the Franklin Institute of Philadelphia, on the occasion of the award to him of the Howard N. Potts gold medal of the Institute for his outstanding work in the development of x ray tubes.

Radium is constantly disintegrating, and in so doing is bombarding electrons —infinitely small particles of matter or electricity—into space at very high velocities. The rate at which radium disintegrates is beyond human control; nothing that man can do seems to affect the rate at which the element breaks down. The cathode ray tube likewise bombards high speed electrons into space, but at a rate that can be controlled by man, and in quantities far greater than by all the radium in the world. The electrons given off by radium are of higher average velocity than those so far produced with the cathode ray tube, but otherwise the two are alike.

So much more concentrated are the rays from the tube that many startling experiments have been conducted with the new device. Crystals of the mineral calcite apparently become red hot coals when exposed for a moment to the rays, but they are glowing with cold light; ordinary salt is turned brown, and considerable time elapses before it again becomes the colorless substance it usually is; bacteria and small flies are almost instantly killed by exposure to the rays; ordinary colorless acetylene gas is transformed into a yellow solid which cannot be dissolved; and a rabbit's gray hair has been destroyed, to be replaced later by a profuse growth of longer, snow-white hair.

Cathode rays have been known to some extent for many years. At first, however, they were known only within vacuum tubes, but about 30 years ago a European scientist, Lenard, succeeded in making the electrons pass through a tiny piece of extremely thin aluminum foil cemented to the glass wall of the tube. Improvements have been numerous since then, but with previous tubes the metal "windows" were much smaller and the operating voltages much lower than with the new tube.

Several unusual features have been incorporated in the new tube. There is a "window" three inches in diameter, of nickel foil, the thickness of which is measured in thousandths of an inch and which is capable of withstanding a total atmospheric pressure of more than 100 pounds. A heated tungsten filament, originally used by Dr. Coolidge in the x



CATHODE RAY TUBE

Explanation of Diagram

Upper—Diagram of tube.
Lower Left—Construction of window.
Lower Center—Details of window, shield and seal.
Lower Right—Section of cathode.

a. Anode window, a very thin piece of nickel foil, through which the electrons pass into the air.
b. Window support, a molybdenum heaxagonal grid, to reinforce the window against the pressure of the atmosphere.
c. Hemispherical cathode cup, focusing the electrons released by the tungsten filament within the cup.
d. Charcoal trap for residual gases. When immersed in liquid air, the charcoal removes all traces of gas within tube.
k. Copper shield, preventing the electrons from striking the glass tube.
m. Water-cooling tube, to prevent the window from becoming heated.
r. Sleeve of invar, an alloy with about the same expansion as glass upon being heated, to which the anode is soldered.
s. Glass-to-invar seal.
t. Cathode shield.

ray tube and now known to all as an essential part of radio tubes, furnishes the supply of electrons. The glass tube has been shielded with a copper tube so that the stream of electrons cannot strike the glass and cause punctures, thereby permitting operation of the tube at voltages far higher than any previously attained, and the tube is also the first which it has been possible to seal off from an evacuating system; the tube thereby has been made as portable and as easy to use as an x ray tube.

Electrons are released by the heated tungsten filament, or cathode and the anode—the "window" and the copper tube which serves as a shield—there is impressed upwards to 350,000 volts of direct current. This causes the electrons given off by the filament to speed up to an average velocity of 150,000 miles per second or more, depending upon the voltage, within the short space of about one inch between the cathode and the copper tube shield. Having attained this high velocity, the electrons coast the rest of the way through the highly evacuated tube and pass through the anode, or window and into the atmosphere with but slight diminution in velocity.

The nickel window is soldered to a disk of invar, an alloy which expands the same amount as does glass when heated. The invar disk, in turn, is fused to the glass tube, thereby making the seal air tight. The thin piece of nickel itself could not withstand the atmospheric pressure of 100 pounds—the difference between the outside air and the almost perfect vacuum within the tube—so it is reinforced with a honeycomb structure of molybdenum metal, a design that affords a maximum of strength with a minimum of cross-section area.

If the tube is operated in a darkened room, a hum is heard and the window of the tube is seen to be surrounded by a ball of purplish haze, about two feet in diameter with 350,000 volts and more or less depending upon the voltage. This glow, which shows the penetration of the cathode rays in air, results from the air being ionized or broken up by the rays or electrons. The penetration of the rays depends not only upon the voltage but upon the density of the substance they strike, so that with most solid substances the penetration is slight, and with dense metals almost negligible.

One of the most startling experiments performed with the new tube has been the production of a yellow compound when the rays are passed through acetylene gas. This compound, similar to that produced in very small amounts by radium treatment of the colorless gas, can be produced in relatively large quantities with the cathode ray tube either as a light, fluffy powder or as a varnish-like film on substances within the gas chamber, depending upon the electrical conditions. The compound has been found to be insoluble in all the many chemicals so far tried. It seems, therefore, that a use may be found for it as a protective coating for metals, to which it adheres tightly. Other substances, such as castor oil, can also be solidified by exposure to the rays.

In ascertaining the effect of the rays on living tissues, small circular areas of the ear of a gray rabbit were subjected

to short exposures to the rays. Exposure of a tenth of a second caused a temporary loss of hair over that area. When the exposure on another area was increased to one second a scab was formed. When this fell away it took the hair with it, and weeks later the area became covered with a profuse growth of longer, snow-white hair. Exposure for a minute resulted in the formation of a scab on each side of the ear. A hole was left in the ear when the scabs fell away, and the edge later became fringed with white hair. In other experiments, bacteria and flies were killed almost instantly by the rays.

A crystal of calcite, a colorless and transparent mineral, glows with a bright orange light if subjected to the rays, and the glow of cold light continues for hours. The glow comes from an area very near the surface of the crystal since the rays penetrate but little into the substance. Immediately after the crystal has been rayed, numerous bluish-white sparks or scintillations can be noticed beneath the surface of the crystal; these are electrical explosions, the result of the bombardment of the atoms in the crystal by the high-speed electrons.

Granite, a mixture of several minerals, glows with several brilliant colors, some of the colors fading away immediately and others remaining for some time. Numerous other substances can be made to change in color, some permanently and others for a short time.

The commercial possibilities of the tube, still a laboratory development, are unknown, but it is expected that the tube will be invaluable in scientific investigations regarding electronic phenomena.

THE STUDENT'S LIBRARY

BOOKS REVIEWED

FUNDAMENTALS OF DERMATOLOGY. By *Alfred Schalek,* M. D., Professor of Dermatology and Syphilology University of Nebraska College of Medicine, formerly Assistant Professor of Dermatology Rush Medical College. Cloth. Price $3.00. Pp. 239 with 54 engravings. Philadelphia: Lea & Febiger, 1926.

The student undertaking the study of dermatology is perplexed at the ambiguity of dermatological syndromes. The designation in Latin of these objective or subjective symptoms as clinical entities is confusing. The present classifications are entirely unsatisfactory.

Having these criticisms forcibly demonstrated by the various groups of students annually coming under his tutorship, and realizing the frequent hopelessness of the general practitioner in attempting to diagnose dermatological conditions, the author presents an alphabetical arrangement of diseases of the skin. In a concise outline the salient principles of the various entities are given.

The anatomy, physiology and general symptomatology of diseases of the skin are discussed. The systematic method of arriving at a diagnosis is given. General therapeutic notes are mentioned.

The text possesses many characteristic illustrations and the material is presented in a concise and a readily assimilative manner.

For the perplexed student of dermatology and general practitioner this text should be a great help in the study of dermatological conditions.

ATLAS OF HUMAN ANATOMY. By *Carl Toldt,* M. D., assisted by *Professor Alois Dalla Rose,* M. D. Adapted to English and American and International Terminology by *M. Eden Paul,* M. D., Brux., M. R. C. S., L. R. C. P. Volume I. Price of two volumes, $10.00. New York: Macmillan Co., 1926.

This international authority has long served the medical profession. Its translation into English and the addition of the International terminology by Eden Paul in 1903 was one of the greatest additions to American medical literature.

The present revision by the publishers is another valuable alteration. Heretofore, the atlas has consisted of three volumes. The set constituted two volumes possessing all the original plates, reproduced in the same manner and bound substantially and attractively. Yet the two volumes are offered for less than half the original price.

In the first volume osteology includes 377 figures, arthrology 113 figures and myology 150 figures. In the second volume, splanchnology has 291 figures, angeiology 291 figures and the section on neurology and organs of special sense 381 figures. The set includes the original 1,505 illustrations drawn to scale from the actual specimens. An accurate pictorial presentation of all the data of human anatomy, arranged by systems and offered for a popular price, this set should be the guide for the student in the dissecting room and the busy physician in practice.

EMERGENCY SURGERY. By *George De Tarnowsky,* M. D., F. A. C. S., D. S. M., Colonel M. C., O. R. C. (378th Medical Regt.), Professor of Clinical Surgery Loyola Uniersity Medical School, etc. Cloth. Price $7.50. Pp. 718 with 324 illustrations. Philadelphia: Lea & Febiger, 1926.

A critic once said that a book in order to become popular must meet a popular need. A medical book becomes "popular" when it presents some new facts, experiences or observations from which deductions can be drawn or when it presents in a more comprehensible form old facts rejuvenated.

Dr. De Tarnowsky fulfills both these requirements. Compiling the fundamentals and generalities of surgery into a new form and supplementing these basic principles with observations and experiences acquired from military surgery, the author presents a valuable contribution to modern medical literature.

The general treatment of wounds, technic of emergency surgery, bacteriology of wounds, and various types of wounds (blood vessels, face, thorax, abdomen, perineal, neurological, etc.) are given initial attention. Burns, shock, cranial and spinal injuries, fractures and dislocations, joint wounds and amputations, all the conditions requiring emergency surgery are discussed. The value of the roentgen ray in emergency surgery has been stressed of late. Medico-legal safeguards are necessary. Correct roentgenogram interpretation is essential. Fluoroscopic examinations are greatly beneficial. The medico-legal aspect of emergency surgery is a necessary evil. The special space given by the author to the discussion of this question is well taken.

The organization of these fundamental principles and their association with measures applicable to emergency surgical conditions makes this text a handy reference for quick and authoritative consultation.

THERAPEUTICS, MATERIA MEDICA AND PHARMACY. *Sam'l O. L. Potter,* A. M., M. D., M. R. C. P. Lond. Fourteenth edition, revised by *R. J. E. Scott,* M. A., B. C. L., M. D. Cloth. Pp. 972. Philadelphia: P. Blakiston's Son & Co., 1926.

In a single volume the original intention of the author was to embrace the essentials of practical materia medica and therapeutics. His successful fulfillment of this attempt is attested by the great demand for the work.

The subject matter has been divided into seven main headings. After presenting some necessary definitions and chemical constituents of organic drugs, the classification of drugs is outlined (acids, alkalies, cardiac depressants, hypnotics, stomachics, etc.) together with their modes of administration, dosages and miscellaneous clinical recognition (as affecting color of urine, excretion in milk, causing eruptions, etc.).

The second division is devoted to Materia Medica and Therapeutics. Here the drugs are alphabetically arranged, their physical and chemical properties are enumerated, preparations and compounds are described, physiological actions are emphasized together with the actions resulting from an ordinary and toxic medicinal dose, and the therapeutic applications are given.

Special Therapeutics elaborately handles alphabetically arranged diseases and symptoms enumerating the drugs used in the conditions, their indications and the authority for such recommendations.

In the Appendix, Latin phrases are given, anti-narcotic and prohibition regulations are abstracted, thermometric, metric, apothecaries and percentage tables are blocked out.

Every title, synonym and other reference of importance is included in the Index.

The text is substantially bound and the type is legible and easily read. The material is excellently arranged in a most available manner. The information is full and complete and well chosen. Such a text is valuable as a student's text and handy as a reference book. The reviewer can recommend such a publication.

INSULIN AND ITS USE IN DIABETES. By *J. J. R. Macleod* and *W. R. Campbell,* Departments of Medicine and Physiotherapy, University of Toronto. Cloth. Price $4.00. Pp. 242 with 24 tables and seven figures. Baltimore: Williams & Wilkins Co., 1925.

This little text demonstrates the co-operation between the physiologist and clinician in the field of research which led to the development of the insulin treatment of diabetes. In this, the sixth volume of Medicine Monographs, Prof. J. J. R. Macleod, physiologist, and Dr. W. R. Campbell, clinician, join forces in the propagation of relationship of these specialties to the development of our knowledge of this condition.

After briefly tracing the history of the investigations which led up to the discovery of insulin by Banting and Best, Prof. Macleod gives the results of a few of their experiments followed by an account of the work of Collip in devising methods for the preparation and purification of insulin. The various experiments that have been performed on depancreatized dogs lead up to its isolation and physiological action. Since insulin is necessary for the oxidation of the inactive glucose and for the formation of glycogen, Prof. Macleod suggests that the formation of glycogen may be a necessary step in the oxidation of the carbohydrate.

The last three-quarters of the text is devoted to Dr. Campbell's clinical application of the new therapeutic adjunct. After presenting the early clinical experiments, the effects of insulin on metabolism are discussed. Overtreatment or the careless administration of insulin often results in a hypoglycemia, the other extreme of the ketosis, acidosis and coma. Both conditions

must be thoroughly understood by the physician and the danger signals known by the patient. Suitable space is devoted to the diagnosis of diabetes mellitus and to the treatment of the condition. Both the dietetic and insulin therapy is emphasized. An additional and valuable chapter on recipes, tables and food equivalents is included.

A folder giving the general directions for diabetic treatment with condensed diabetic diet lists accompanies the text.

A valuable scientific presentation by recognized authorities of one of the greatest of medical discoveries, this text deserves the serious consideration of medical practitioners.

TEXTBOOK OF UROLOGY. By *Oswald Swinney Lowsley*, A. B., M. D., F. A. C. S., Director of the department of Urology of the New York Hospital, and *Thomas Joseph Kirwin*, Ph. C., B. S., M. A., M. D., Chief of the Clinic of the department of Urology of the New York Hospital, Assistant in Urology, Cornell University Medical School. Cloth. Price $10.00. Pp. 699 with 233 figures. Philadelphia: Lea & Febiger, 1926.

This text is the result of eighteen years intensively devoted to the study of urological conditions—clinical experience being supplemented by laboratory research. Masters in their own and foreign countries have been their teachers. Special recognition is given Drs. Edward L. Keyes, Jr., and Alfred T. Osgood.

The material is arranged in comprehensible outline form. The historical background is concentrated into a single introductory chapter, followed by a discussion of the diagnostic procedures of urology. The parts and organs are then considered in their anatomical sequence from outward inward. The embryology, anatomy, and anomalies of each are followed by a concise description of the injuries and diseases of the organs. Etiology, symptomatology and the approved methods of diagnosis precede a discussion of their treatment. The recognized operative methods are presented with personal observations as to their applicability. Drawings and photographs are of distinct assistance in their presentation. At the end of each anatomical consideration an extensive bibliography is offered for further study.

To include the subject in a single volume, a vast amount of material must be studied, classified and evaluated, a definite outline must be followed, and the conclusions must be presented in a clear and concise manner. Fulfilling these requisites with an authoritative judgment and combining them with the evident co-operation and ability of the publishers, bespeaks for this text early recognition.

INTERNATIONAL ABSTRACTS

ROENTGEN BURNS

Treatment of Deep Roentgen Ray Burns by Excisions and Tissue Shifting. John S. Davis, M. D., J. A. M. A., 86:3002, Jan. 23, 1926.

When the ordinary local methods have been tried for a reasonable time in a deep roentgen ray burn, nothing is gained by delaying operative work. Early excision of deep burns with tissue shifting promises more than any other method yet devised, and gives a reasonable prospect of permanent relief in a comparatively short time. Pain is eliminated, in many instances function is restored, and patients who have been incapacitated for years have been returned to their former activities. The ultimate results have been most gratifying.

PHYSICAL APPLICATIONS

The Dermatological Firing Line. Wm. J. MacDonald, M. D., Boston M. & S. J., 194:152-155, Jan. 28, 1926.

In this short article the author, under the heading of the different therapeutic measures, enumerates the conditions to which they are individually applicable. Discussing first the place of the roentgen ray in the treatment of dermatological conditions, eczema occupies the foremost position. Acne vulgaris, rosacea, psoriasis, ringworm of the scalp, sycosis vulgaris, hyperkeratoses, hyperidrosis and keloids, all are amenable to roentgen ray therapy.

Radium is a necessary part of the skin specialist's equipment. It is most commonly used in the treatment of basal cell epithelioma, small keloids, nevus vasculosus, cavernous angioma, senile keratoses, verrucae, sarcoid, synovial cysts of the skin and lupus erythematosus. Radium has not been so extensive in its application to dermatology as the x rays.

Ultra violet therapy from the quartz lamp has proven an excellent method of combating generalized psoriasis, pityriasis rosea, seborrhoeic eczema of the body, pruritis and winter itch. Acne vulgaris has not responded well to the ultra violet rays in the hands of the author. As regards dosage, they commence with a short exposure of a few minutes at a distance of 20 inches. Every alternate day the light is brought closer to the skin and the time is increased.

With the galvanic plate and patience, the dermatologist can remove from the faces of his lady patients those superfluous hairs that cause them so much mental anguish. Small nevi, moles and xanthelasma can be excellently treated with the electric current.

CANCER BREAST

Recurrent Inoperable Carcinoma of the Breast. Burton J. Lee, M. D., and Norman E. Tannenbaum, M. D., J. A. M. A., 86:250-256, Jan. 23, 1926.

Recurrent mammary cases classified as inoperable consisted of not only those cases exhibiting metastases to axillary nodes on same or opposite side, involvement of opposite breast, intrathoracic, bony or distant organ metastases, but also those in whom recurrent diffuse nodules appeared in the operative field, fixed recurrences to the chest wall and supraclavicular fullness. The average age of the patients at the beginning of symptoms was 46 years. The youngest

was 23 and the oldest was 70 years. The average age of the time of the first visit to the hospital was 52 years, the youngest patient being 24 and the oldest 80.

The agent most frequently employed was the roentgen ray, because the lesions were best handled by the roentgen ray therapy. The next greatest number were treated by a combination of radium and the roentgen ray, both forms being used over identical areas of skin quite frequently. Radium alone as an agent for treating inoperable recurrences had the least use, but some of the most striking results were obtained in this way.

The low voltage roentgen ray was employed in the majority of cases, consisting of a series of cycles of from one to five exposures, depending on the number of areas to be treated. The time of treatment varied from seven to twenty-five minutes. The set-up used was with a kilopeak voltage of from 135 to 140, 4 milliamperes of current, a focal skin distance of from 10 to 12 inches, and 4 mm. aluminum filtration. The dosage varied with the individual case, this form of treatment being used for supraclavicular or axillary involvement, for diffuse cutaneous recurrences, intrathoracic and intraosseous metastases. Striking disappearances resulted.

High voltage roentgen therapy was employed in certain well chosen cases of intrathoracic metastases, as well as some bony metastases in the spine and pelvis.

Radium therapy, in the form of the radium pack or tray, was used for large, well circumscribed recurrences, while bare tubes of emanation were employed in the smaller superficial recurrent nodules or in axillary nodes.

Of the 363 patients analyzed as to the course and type of treatment employed in the recurrent, inoperable and metastatic carcinomas, treatment of the favorable group of 205 cases gave fairly good results. Thirty-four were alive at the time of the report, which was 9 per cent of the total number and 17 per cent of the favorable group. The total number alive without evidence of any lesion is 18, while 16 have disease still present. The average duration of life of this group since recurrence is slightly over five years.

This survey points favorably to the treatment of recurrent inoperable carcinoma of the breast by irradiation and gives a definite prolongation of life and an amelioration of many symptoms.

ENLARGED THYMUS

An Enlarged Thymus in an Infant: Tetany After X Ray Treatment. M. J. Konikow, M. D., 9:70-75, January-February, 1925.

The case is reported of an infant born with an enlarged thymus with all the symptoms of severe dyspnoea present with his first breath and with tetany following about five weeks later after two x ray treatments were given.

Injury to the parathyroid glands by the x ray therapy is advanced as the etiological factor of tetany in this case. The failure of calcium and the parathyroid treatment is noted. The relation of the enlarged thymus to other malformations in children is noted and discussed.

CANCER OF BREAST

Prognosis in Cancer of the Breast. J. H. Blackburn, M. D., F. A. C. S., Kentucky M. J. 24:56-64, January, 1926.

A classification is given based on the stage of the disease: (1) A small tumor not adherent or barely adherent to the skin and not more than one or two enlarged axillary glands, usually found at operation; (2) skin adherent to a moderate sized growth, with palpable glands in axilla; (3) most of mammary glands involved and tumor adherent to skin and to deep fascia; submaxillary glands often enlarged.

In group 1 all cases should be given routine preliminary and postoperative radiations regardless of the stage of the disease. In the early cases the low-voltage x ray current is used. In the primary inoperable cases of group 3 the results obtained by radiation in properly selected cases

are unquestioned. In the rapidly growing inflammatory type the use of x ray offers practically the only hope for relief, as operation is always followed by a rapid recurrence and shortening of life of the patient. In the borderline cases of group 2 some use only the postoperative radiation, while others advise preliminary and postoperative radiation.

Radium finds its greatest field of usefulness in the treatment of cancer of the breast in the local recurrences that occur in the intercostal spaces and at times in the subclavicular region. If the recurrence is small and limited a more direct application may be attending danger than could be accomplished by x radiation.

MAGNIFYING STEREOSCOPE

A Magnifying Stereoscope. Erik Lysholm. Acta Radiol., 5:109-111, January, 1926.

In this short illustrated article the writer describes his observations as the result of using an ordinary Zeiss field glass and attachable lenses both for the uniocular enlargements and for stereoscopic enlargements. He examines the question as to what attachable lenses are best suited for roentgen examination.

ROENTGEN ACCIDENT

A Roentgen Accident With a Fatal Result Through the Short-Circuiting of the Secondary Current. G. A. Wetterstrand. Acta Radiol., 5:105-108, January, 1926.

The writer gives an account of the course and causes of a roentgen accident which took place in Finland in 1924, and which cost the doctor and the nurse their lives. It may be regarded as established that the cause did not lie in the apparatus itself, but in an unprecedently imprudent manipulation of it. When they were trying to center the tube, and when the high-tension current was coupled without a break, both the doctor and the nurse came into contact with a pole. The distance between them was so small that a series coupling parallel with the roentgen tubes came about, and the high tension current found its way in the form of an arc of light, involving immediate death.

It is evident that measures of isolation and safety are of no avail in a case like this, where the cause is to be finally sought in a lack of theoretical and practical training. As to some extent contributing to the possibility of roentgen accidents the writer considers the current practice, whereby the purveyor does not in any way try to obtain a guarantee that the instrument will be correctly manipulated. This delicate and difficult problem seems to me worth discussing.

LEYDEN DISCHARGES

Figures de Decharge de la Bouteille de Leyde. Dr. J. van Ebbenhorst Tengbergen, Acta Radiol., 5:56-62, January, 1925.

The writer describes the peculiarities of the figures that emit from the discharges of Leyden jars at higher potentials on duplitized films. The conclusions may be drawn out of these observations that the figure on one side of the film is not dependent on superposition of more oscillations, but only on half a wave and that the shape of the figure on the other side is being induced by the former. As a result of these observations the authors conclude that there only are negative Lichtenberg figures, that the positives are deformed negative figures.

DUODENAL ULCER

A Study of Duodenal Ulcer with Special Reference to Symptomatology and Diagnosis. F. L. Snyder, M. D., J. Michigan State M. S., 24:419-421, August, 1926.

Duodenal ulcer is a chronic disease manifesting itself according to a rather constant classical picture. Variations from the picture occur in about one-fourth of the cases, suggesting more

often a diagnosis of gastric ulcer, chronic cholecystitis, or chronic appendicitis.

Important chronic complications develop in the lesion, necessitating surgical interference in one-fourth of the cases. Roentgen ray examination gives a most accurate interpretation of these changes.

The type of treatment suitable to a particular case involves not only an understanding of the local lesion, but an evaluation of the social, economic and personal status of the patient.

Symptoms Associated with Duodenal Retention and Reverse Motility. Homer Wheelon, M. D., J. A. M. A., 86:327-330, Jan. 30, 1926.

The observations and conclusions here presented are derived from a study of seventy-seven consecutive patients who came to surgery for correction of pathologic processes in the abdomen. Roentgenologic results were entirely based on fluoroscopic examinations. Plates gave meager information relative to motility, and served only to record definite anatomic abnormalities. Observations were made with patients in the upright position.

Symptoms associated with duodenal retention and reverse motility were of two types. Of the subjective symptoms, a sense of localized fullness or weight was mentioned by 23, while symptoms of reverse movements of barium such as nausea, pain, faintness, etc., were complained by 64. Definite duodenal involvement was observed by 52 of the 64. Objective symptoms of belching, regurgitation and vomiting were noted in 49.

Of the 70 coming to operation for relief of duodenal symptoms, duodenal retention and reverse motility was observed in 74. At operation duodenal involvement was found in 58, or 75.3 per cent. In 16 patients showing fluoroscopically duodenal retention and reverse motility, the duodenum was free from demonstrable pathologic changes.

These findings suggest that distention of the duodenum is sufficient stimulus to elicit subjective symptoms and that duodenal distention or retention results in or is followed by the appearance of forces—waves—which pass material toward the stomach and which is often associated with or produce nausea, pain, uneasiness, regurgitation of duodenal contents into the stomach, vasomotor and neuromuscular disturbances, belching and vomiting.

GASTROENTEROSTOMY

Observations on the Function of the Stomach after Gastroenterostomy and Similar Oppperations. Dr. L. Arisz, The Hague, Acta Radiol. 5:236-249, June, 1926.

An analysis has been given of conditions found in enterostomized stomachs. It has been found that the operation diminishes the motility, but does not change the possibility of peristaltic movements and the pyloric mechanism. The role of both, however, depends on the extent of discharge through the anastomosis, and on the position of the patient during the examination. In enterostomized stomachs ulcers go on producing spastic deformities of the gastric wall and hindering peristaltic movement; the enteromized stomach with an ulcer, therefore, is different from the enteromized stomachs without the ulcer. The obvious result of the operation is the discharge through the anastomosis; it has been considered in what extent the conditions of ulcers have changed when this second way of discharge is present, but no definite change could be found. The benefits patients usually experience could not be explained by the author.

CHOLECYSTOGRAPHY

Experiences with Cholecystography. L. R. Whitaker, M. D., J. A. M. A., 86:239-243, Jan. 23, 1926.

For the purpose of cholecystography, the most satisfactory medium for the authors has been sodium tetraiodophenolphthalein. The intravenous method of administration has

proven the most reliable and is not dangerous. The oral method is simpler and more widely applicable, though not quite so accurate as the intravenous.

Cholecystography furnishes a means for the study of gallbladder function. The observations of the author supported by those of numerous others seem to prove that the gallbladder empties its contents into the duodenum after the ingestion of fat rich foods.

Experiments were carried out that reflect doubt on the value of non-surgical biliary drainage by magnesium sulphate, since the gallbladder drains more completely after the ingestion of fat than after the intraduodenal administration of that drug.

RESPIRATORY SYSTEM

TUBERCULOUS LARYNGITIS

Tuberculous Laryngitis from the standpoint of the Physician. C. L. LaRue, M. D., Colorado Med., 22:276-280, August, 1925.

Practically all patients suffering from this disease have one or two rather constant early symptoms: (1) a husky voice that frequently leads to aphonia; (2) a sensation of laryngeal discomfort.

Tuberculosis of the larynx is not to be regarded as a local disease, but as a manifestation of a constitutional disease. The patient may be advised that as his pulmonary condition improves, the laryngeal condition will undoubtedly improve.

The treatment is based on four fundamental conditions. The first is that the resistance of the larynx is usually proportionate to the constitutional resistance. The second principle is rest, and the third galvanocautery to eradicate the infected area. In the fourth adjunct chemical cautery, heliotherapy and lamp therapy are included.

PULMONARY ATELACTASIS

Some Cases of Pulmonary Atelactasis. Sven Junghagen. Acta Radiol., 5:250-261, June, 1926.

The author reports three cases of pulmonary atelectasis as a result of bronchial obturation. (1) Foreign body in the main bronchus on the right side with total atelectasis of the lung after not quite twenty-four hours is one peculiar case reported. (2) Enlarged lymphogranulomatosic glands compressing the upper bronchus on the right side with atelectasis of the upper lobe constitutes a second case. (3) The third case consists of an aneurysm compressing the main bronchus on the left side with total atelectasis of the left lung.

All three cases show the characteristic roentgenologic changes with a haze over the affected lung field and shrinkage of the lung besides secondary shrinkage phenomena of the thorax and medtastiium.

HILUM TUBERCULOSIS

The Diagnosis of Clinical Hilum Tuberculosis. John B. Hawes, 2nd, M. D., Boston M. & S. J., 194:91-96, Jan. 21, 1926.

In the presentation of this paper, Dr. Hawes takes up certain diagnostic points: (1) those relating to the history of the child; (2) symptoms; (3) physical signs; and (4) x ray evidence in diagnosis.

In obtaining the history of the child certain points are of importance: exposure to tuberculosis, freuent coughs and colds, frequently a history of whooping cough or measles, enlarged cervical glands, and the grouping by the parent of the child in the "delicate class" against the thin wiry type or the strong robust child.

In the symptomatology, there is the ease of tire, always tired, fatigue, changes in temperament, loss of weight and malnutrition.

Physical signs are so variable in this condition that the writer puts very little stress upon them.

As to the value of the x ray in the diagnosis of hilum tuberculosis, the following statements result:

"I believe that the x ray is an aid in diagnosis, but never in itself nor by itself should it be used to diagnose hilum tuberculosis.

"I do not believe that the x ray can distinguish between abnormal root shadows that are causing symptoms and equally abnormal root shadows that are not causing symptoms.

"I do not believe the x ray can differentiate hilum shadows due to non-tuberculous infection from those due to tuberculosis except of course when there are calcified glands.

"I have seen no evidence to make me believe that the x ray men have settled on any standard by means of which they can differentiate the normal from the abnormal root shadows.

"On the other hand, I have every reason to believe that the x ray man differs from his fellow roentgenologist and is a law, or rather, an opinion unto himself as far as this question is concerned.

"I believe that as a general rule practitioners accept x ray evidence and the dictum of the x ray man far too readily and do not use their common sense and powers of observation enough."

For a positive diagnosis of hilum tuberculosis, the author itemizes:

1. Exposure.
2. Real malnutrition and real underweight.
3. Ease of tire. Being tired all the time.
4. Temperamental changes.

Of importance but not essential to a diagnosis, he mentions:

1. A positive Von Pirquet.
2. X ray evidence of marked hilum changes.

SURGICAL TUBERCULOSIS

Observations on Artificial Light Treatment in Surgical Tuberculosis. Sir Henry Gauvain. Brit. J. Tuberculosis, 20:1-11, January, 1926.

The scientific basis for light therapy still rests on uncertain grounds, and it distresses the scientific mind that exact rules for treatment, based on laboratory findings, cannot as yet be accurately formulated. This need occasion no surprise. So many sources of light of varying and variable intensity, of differing wave lengths or varying combinations of wave lengths are employed, and there are such considerable variations in the response to treatment of different individuals, and even of different tissues in the same individual, that the subject becomes exceedingly complex, and rigidly scientific treatment is not as yet practicable.

Two types of carbon arc lights are used at Alton, similar to those used at the Finsen Institute—the 75 and 20 ampere lights. The longer exposures of the Finsen lights seem to be tolerated by the patients better than the shorter exposures of the carbon arc lights so commonly used in England. Deeper penetration is insured by the Finsen light—a therapeutic benefit. With the 75-ampere lamp from six to eight seated patients may be treated simultaneously, as near to the lamp as the heat will permit. As a rule exposures are given on alternate days, commencing with, for children, twenty minutes, and increasing by ten minutes to a quarter of an hour per session up to a maximum of two and a half hours. For recumbent patients two, in the case of children or three, in the case of adults, 20-ampere carbon arc lamps are used, two patients being treated simultaneously, and details of exposure as with the 75-ampere lamp.

The author advocates intermittent exposures. At Alton, after from two to three months' treatment, a rest period is given. Change of air, scene and natural sunlight is advocated.

For the local treatment of sinuses, glands or patches of scrofuloderma, mercury vapor, tungsten, arc, or iron arc is often of value. Often radiant heat baths before the general treatment are beneficial.

For the local treatment of lupus, no lamp has proved as valuable as the Finsen-Reyn water cooled carbon arc lamp with suitable applicators.

The author urges that the artificial light treatment should always be under informed medical

guidance. Careful records should be kept on all patients treated, and clinical experience aided by laboratory control should be the guide in an intriguing, but as yet insufficiently understood, method of treatment.

PNEUMONIA

Unresolved Pneumonia in Children. Gerard N. Krost, M. D., Am. J. Dis. Child., 30:57-71, July, 1925.

It was in the fall of 1923, when the author fluoroscoped a baby with an undiagnosed lung condition who in less than twenty-four hours began to show signs of resolution. The mild dose of roentgen ray given the child was apparently a factor in causing the resolution of the pneumonia which had been present for weeks. Following this notation, twelve children suffering from unresolved pneumonia were treated with small doses of roentgen ray. Eleven showed apparent benefit. The dosage nor method of determining the dosage on these young patients, varying from six months to 12 years, was given in the report.

OSSEOUS SYSTEM

RICKETS

Therapy of Rickets. S. Rosenbaum. Monatschr. f. Kinderh., 30:547, 1925

In this study for the determination of the effects of different remedies on the course of rickets, children from 12 to 20 months of age were used. The progress of the disease and the results obtained by the various therapeutic measures were determined by the x ray.

The patients were kept in the same room, with the exception of a special out-of-doors group that was kept as control. All were kept on the identical diet.

The only remedy that was at all successful in effecting the course of the disease was either real or artificial sunlight. Attempting to determine whether the beneficient results were due to some chemical action of the rays or to the irritation of the skin, mustard baths, massage and salt rubs were used without effect.

Wondering if the healing element in light might not be absorbed and transmitted by light, blood was submitted to two minutes' exposure and injected into the veins of the patients in doses of 5 c.c. Twenty-eight such injections had no influence on the course of ths disease.

ACHONDROPLASIA

Sur La Question De L'Achondroplasie Atypique et Se Sa Peripherique. Nils Silfverskiold. Acta Radiol., 5:223-235, June, 1926.

Four cases serve as the basis for the discussion of atypical achondroplasia and its peripheral localizations. Two of these cases, mother and son, show on the whole identical skeletal changes, mainly localized to the peripheral parts of the extremities and caused by disturbances in the enchondral ossification and of achondroplastic nature. Another case of achondroplasia shows a tripartite patella and the x ray pictures of shoulder and hip joints remind one of the so-called local malaciae.

SPECIAL SENSES

THERMOTHERAPY

Thermotherapy in the Eye, Ear, Nose and Throat. T. S. Blakesley, M. D., F. A. C. S., Physical Therao., 44:6-19, Jan., 1926.

In the experience of the author, conversive heat by electrical energy is the most valuable form of thermotherapy. Definite beneficial effects occur in diseased tissues by use of this agent. Its technique must be accurate and must be varied according to the condition under treatment, based on a knowledge of the pathology existing.

Thermotherapy by electrical energy is not a cure-all, but is a valuable aid in those conditions

benefited by heat. It is dangerous when used unwisely and should only be used by one with an understanding of electricity and pathology and a willingness to be patient.

TONSILAR INFECTIONS

The Uses of X Ray and Desiccation in the D. McFee, M. D., Physical Therap., 44:1-6, Jan., 1926.

Many methods are now in use for the treatment of infected tonsils besides the surgical procedure. Radium, x ray, actinic ray, and the high frequency current have all been applied. The author advocates the use of the method devised by Dr. Herman A. Osgood for the treatment of infected tonsils by the roentgen ray.

The patient lies face downward on the treatment table with a pillow under his shoulders. The head is turned first on the right side, then on the left, and the chin is raised. The ears are strapped forward. In this way an oblique surface is obtained at the angle of the jaw for the unobstructed penetration of the roentgen rays. For protection, use a square foot of lead rubber with a rectangular cut in the center, three inches by one and a half inch, placed over the head of the patient, so that the area behind the angle of the jaw and below the auditory meatus is exposed. The formula used is milliamperes 5, filters of aluminum three millimeters, spark gap six inches, distance ten inches, time six minutes, time intervals one week. Using the two and one-half inch square cone or the circular cone two inches in diameter, the x rays from the Coolidge tube are centered upon the tonsillar area just below and back of the jaw, with the rays directed towards the lower molar on the opposite side.

The writer has found, after treating many tonsil cases extending over a twenty-year period, that while the results have been satisfactory in a comparatively few patients by x ray and actinic ray alone, a far greater number have required added treatment by electrodesiccation, according to the following technique:

The monopolar current is used. A white spark is preferable. Crypts are cleaned out, and with the patient in the upright position facing the light, the tonsils, pharynx and umula are swabbed with a solution containing equal parts of 1/1000 adrenalin and 10 per cent cocaine. With mouth open and tongue held down with tongue depressor, the electrode is introduced so that the glass covering, which projects one quarter to one inch beyond its metal point, touches the tonsil. The previously tested high frequency current is turned on and a spark rapidly passed over the tonsil surface until a white film occurs. The tonsil should not be penetrated by the electrode. In most cases both tonsils may be treated at one sitting. A slight irritation of the throat is felt for one or two days; in a period varying from five to seven days the throat will be found clear, and a similar treatment is then given at these intervals until the maximum result is secured, usually in about six weeks.

ELECTROTHERAPEUTICS IN UROLOGY

Victor Cox Pedersen, A. M., M. D., F. A. C. S., Am. J. Electroth. 43:301-307, Aug., 1925.

In his discussion of this subject the author presents fundamental principles which may be applied to all electrotherapeutics.

Electrotherapeutics, says the writer, are not absolutely infallible. Anyone undertaking application with such enthusiasm will certainly be disappointed. Their application is limited, and in many instances the results are contradictory. Whenever unusually good results are expected, they are not forthcoming, and when negative or disappointing results are rather in the order of events, the contrary may be seen. The real points to remember are that the apparatus now available is suitable for real progress and, if distinctions in physical actions are known and proved, and if diagnoses are accurately made, then a common ground is reached from which

real deductions may be drawn. The author has said there are a few basic principles which are altogether too often neglected. The patient must not be hurt or frightened; electrotherapy must be employed to augment all other measures, and not necessarily to supplant any; the current must produce profound circulatory effect of creative character, and it must be opposed to the circulatory condition of indolent character due to disease; the modalities must be varied influences; and finally the electrotherapeutic measures must leave no evil after effects. If these simple principles are obeyed, little trouble will be encountered.

GONOCOCCAL INFECTIONS

Treatment of Gonococcal Infections by Diathermy. E. P. Cumberbatch, M. A., B. M., B. Ch. (Oxford), D. M. R. E., (Cambridge), M. R. C. P. (London), F. I. S. Ch. (Hon.), Physical Therap., 44:19-33, Jan., 1926.

The application of diathermy to the cervix or prostate and seminal vesicles—the gates to metastasis—is a specific for gonococcal arthritis. Early cases are cured, late cases are arrested. Diathermy has also proved to be a rapid and certain method of bringing gonoccal orchitis and epididymitis to an end. The symptoms and usually the signs of gonococcal salpingitis can be removed by diathermy, if there is no pus or pent-up fluid in the tubes. All evidence of gonoccal infection in the urethra and cervix uteri in women, and of the prostate and vesicles in men is negative after diathermy.

BENIGN HEMORRHAGE

Treatment with Radium of Uterine Hemorrhage from Benign Lesions. A. Strauss, M. D., F. A. C. S.; and Lawrence A. Pomeroy, M. D., F. A. C. S., Ohio State M. J., 21:493-496, July, 1925.

Four classes of cases are considered in this discussion on uterine hemorrhage (1) fibromyoma; (2) fibrosis uteri; (3) polyps; (4) essential hemorrhage possibly due to ovarian dystrophy.

In treating fibromyoma of the uterus, the entire length of the canal is radiated. Either due to action on the ovaries or because of the elimination of some endocrinal function that the endometrium may perform, menopause results. The fibrous and muscle tissues of the uterus are susceptible to gamma rays of radium, causing a gradual shrinking that is complete in six months. But if the patient is a good surgical risk, she should be close to 40 years of age before radium therapy is given preference over surgery. Before radiating fibroids, under nitrous oxide anaesthesia, a thorough pelvic examination is made, followed by dilatation and curettage to rule out malignancy. The dosage administered is usually from 1200 to 2600 mg. hrs.

In fibrosis uteri if the women are over 40 or are approaching the menopause, a single application of radium usually relieves the conditions. The same preoperative precautions for the determination of malignancy are enforced.

Polyps are distinctly precancerous lesions. They are prone to recur if treated only by curettage and cauterization. Intrauterine application will eradicate all polyps and stop the bleeding and discharge.

Essential hemorrhage is found in women under 30 years of age who give a history of having menstruated irregularly since puberty, sometimes profusely over a scant period, sometimes moderately or scantily over a longer period. Glandular extracts are usually given without relief. Radium is applied intrauterine, not sufficient to cause premature menopause. A treatment of 100 mg for four hours is given. This will generally cause regular menstruations or a moderate flow, to be followed by normal menstruation. Occasionally the dose is too small. It should then be repeated, but not sooner than three months.

MISCELLANEOUS

RADIODONTIA

The Teaching of Radiodontia in Dental Colleges. Clarence O. Simpson, D. D. S., M. D., Internat. J. Orthodontia., 9: 1150-1154, December, 1925.

The teaching of radiodontia in dental colleges has been the problem occupying the mind of Dr. Simpson for years. It is a fact too self-evident that in those colleges attempting to teach radiodontia the didactic course usually consists of lectures memorized from textbooks on electricity, x ray, physics, etc., impractical to the future dentist. Dr. Simpson believes that the theoretical phase of radiodontia should be taught in the junior year while the students are "still susceptible to teaching." The theoretical study should begin with a lecture on electricity, briefly reviewing the forms, currents, and units of measurement. Concise rules should be memorized rather than attempting to teach by tedious explanations. The second lecture should cover x ray physics including transformers, tubes and x ray characteristics. Following in order should be lectures on the practical application of projection rules, a detailed study of anatomic regions with the landmarks, the preparation and posing of the patient, and the placement of films, and angles for projection of each region. The lectures on technic should be supplemented by repeated demonstrations to better impress the necessity for system in operating. The next subjects to be considered are the uses of radiography in the different branches of dentistry, the requirements of an adequate radiodontic examination, the fundamentals of interpretation and the dangers and protection in radiodontic practice. Radiodontic interpretation can best be taught by having students study the evidence and give their interpretation, then modifying or correcting their interpretation by directing attention to the distinctive features.

Such a course would undoubtedly be valuable to the cause of radiodontia. But the question as to the practicability and necessity for such a subdivision is a debatable question.

The technique advised by Dr. Simpson is very nicely presented in a recent publication by him under the title of "Technic of Oral Radiography," published by C. V. Mosby Co.

X-RAY EQUIPMENT

The Private X Ray Equipment. Charles D. Enfield, M. D., Med. Sentinel., 33: 496-501, Sept., 1925.

In the presentation of this article the author looks upon the specialty of roentgenology in its financial light. There are others, other than roentgenologists, to whom x ray equipments have appeared as necessities. There are some to whom it should be a great aid: the general practitioner so situated that expert roentgen consultation is not available; the internist desirous of fluoroscopic chest and particularly cardiac work; the industrial surgeon with his fractures; and the gastroenterologist. Even to these the financial stress will be greatly increased. Figures on the cost of the equipment, depreciation, maintenance, etc., are impressive, as they depict conditions as they exist.

CHOLECYSTOGRAPHY

A SYMPOSIUM

Cholecystography. Eggert Meller and David Ottosen. Acta Radiol., 5:313-331, Aug., 1926.

A description is given of Graham & Cole's method of roentgenological visualization of the gallbladder; of the development of the method up to the present time, and of the most important results it has yielded.

The technique given by the author is one of intravenous infusion of the contrast agent and for the roentgenograph at periodic intervals afterward.

The method described has been applied to 36 cases, with 42 examinations altogether:

1. Local reaction did not occur in any case.

2. Mild or moderate general reaction occurred in six cases.

A description is given of the roentgenograms of 22 cases which must anticipatively be considered as free from diseases of the gall bladder and the bile ducts. An attempt is made at giving exact measurements for the size and location of these gall bladder shadows.

A report is included of the results arrived at in 14 cases in which previous routine examination was more or less in favor of diseases of the bile ducts.

FREQUENCY OF G. B. DISEASE

Cholecystography and the Diagnosis of Chronic Gallbladder Disease. K. Winslow, M. D., and C. Melgard, M. D., Northwest Med., 24:124-128, March, 1925.

No chronic disorder is half so common as gall bladder disease, and no symptoms are half so vague and varied. The most frequent symptoms are gas, belching, distention—all aggravated by large meals, by acid and fatty foods. Tenderness over the site of the gall bladder is a most important sign, but is often confused with the tenderness so often related to duodenal ulcer.

In the differential diagnosis, duodenal ulcer occupies an outstanding position. Gastric analysis is frequently of assistance, but the frequency of chronic appendicitis, chronic cholecystitus and duodenal ulcer being inter-related confuses any methods of differentiation.

Early in 1924 Graham and Cole of St. Louis developed the intravenous injection of an analin dye and the x ray visualization of the gall bladder shadow obtained by its concentration in the cytic cavity. The shadow of the normal gall bladder is oval or pear-shaped and should be of uniform outline, homogeneous in density, and varies in size with the filling and emptying of the dye. Abnormalities are shown by a faint or wholly absent shadow, by delay in filling or emptying, by deformities in contour, by unvarying size and by mottling of the shadow.

Failure of the dye to fill the gall bladder may be due to obstruction of the cystic or common duct (?) by tumors, stones or adhesions, or by the presence of inspissated bile. Mottling of the shadow of the gall bladder may be caused by stones, papilloma or pressure of the bowel. Carman found that in 19 out of 25 cases of gallstones, the gallbladder failed to fill with dye. Without dye, x ray showed stones in only six of these patients. The dye showed trouble in 96 per cent of these 25 cases of gallstones.

The absence of the shadow is of chief importance. The less you see the more it means in skiagrams of the gallbladder with dye administered.

ITS DEVELOPMENT AND APPLICATION.

Cholecystography: Its Development and Application. Evarts A. Graham, M. D., Warren H. Cole, M. D., and Glover H. Copher, M. D., Am. J. Roentgenol., 14: 487-495, Dec., 1925.

The routine procedure which the writers have come to follow in the clinical application of the elimination of the gallbladder of the iodine salts is as follows:

For an individual weighing 125 pounds or more, 3.5 gm of the sodium salt of tetraiodophenolphthalein is dissolved in 28 or 30 cc of freshly distilled water. The solution is filtered through a fine filter paper and sterilized in a boiling water bath for fifteen minutes. For convenience this has been put up in sterile ampules. This solution is given intravenously in two doses, one-half hour apart, in the morning before breakfast, between 7:30 and 9:00 a. m. Care must be taken to avoid extravasation outside the vein during injection. Certain orders are essential for the patient:

1. Breakfast should be omitted.

2. Lunch should be omitted, but the patient may have a glass of milk.

3. Protein should be omitted from the evening meal.

4. Water is allowed ad libitum.

5. Alkalinization of the stomach contents by frequent doses by sodium bicarbonate by mouth is helpful.

Roentgenograms are taken in series, at four, eight, twenty-four and thirty-two hours after injection. The following technique is used for making the cholecystograms: a radiator Coolidge tube is used with duplitized films under double intensifying screens. The smallest practical diaphragm is used, and compression is made with the cone on the patient, who lies on his abdomen on the table. A flash exposure is made, a 60 ma. current with a 5-inch spark gap being used. The spark gap varies with the thickness of the patient. The Bucky-Potter diaphragm may be used, but it does not seem essential.

If the above technique is carried out, a normal gallbladder will show rather definite reactions: Usually at about the fourth to the seventh hour after the injection a faint but definite outline of the gallbladder appears, which is seen to have the contour of the normally shaped organ, but to be somewhat larger than normal gallbladders usually seen at laparotomy. At the end of the twenty-four hours the shadow is much more distinct but contracted down to only about one-half of its earlier size. From then on until about the forty-eighth hour the shadow diminishes in size and fades gradually.

Abnormalities of the gallbladder reveal themselves in various ways. A failure to obtain any shadow after carefully carrying out the preceding technique has invariably indicated definite pathology of the biliary tract. It is conceivable, however, that in rare instances of very serious disturbance of hepatic function an insufficient amount of the substance might be secreted to produce a shadow even without any appreciable alteration of the gallbladder, but the writers have never encountered this difficulty. Abnormalities of less degree have shown themselves by such phenomena as late appearance of shadow, failure to diminish in size, distortion of outline, irregular mottling, etc. As experience with the method increases it becomes more and more evident that it is an index of function of the gallbladder rather than one which shows sharply distinct pathological lesions. For example, two such different pathological conditions as obstruction of the cystic duct and a fibrosed gallbladder without obstruction of the cystic duct will both usually result in a failure to obtain a shadow. The reason for this lies in the fact that, although in the first instance the substance has not been able to enter the gallbladder, in the second instance the gallbladder has not been able to exercise its normal function of concentrating the bile. The sensitiveness of cholecystography in revealing abnormalities of function of the gallbladder is one of its most striking assets in the diagnosis of slight degree of cholecystitis. It is because of the sensitiveness to slight functional changes that cholecystography becomes of great value in the diagnosis of the cases of early and comparatively slight cholecystitis which are most difficult to diagnose by any other method, either clinical or laboratory. In several instances the authors relate that they have removed doubtfully normal gallbladders on the strength of the cholecystographic findings and later have found them to show definite signs of inflammation with the microscope.

Using either the iodine or bromide salt, 261 individuals have been studied by cholecystography. Of this number it has been possible for the authors to verify their diagnosis in 80 patients upon whom operation has been performed. In this series of cases, 96.25 per cent of cholecystographic diagnoses have been correct. In the last 20 cases which have come to operation the cholecystographic diagnosis has been confirmed in every one.

INTRAVENOUS METHOD

Clinical and Experimental Cholecystography. M. C. Sosman, M. D., L. R. Whitaker, M. D., and P. J. Edson, M. D., Am. J. Roentgenol., 14:495-503, Dec., 1925.

The intravenous administration of sodium tetraiodophenolphenolphthalein is a very accurate and reliable test for a non-functioning or poorly functioning gallbladder, being found reliable in 93.5 per cent of proved cases in the clinic of the writers at Boston. It is quite safe if used in the dose and by the technique recommended.

The oral administration is much easier, but gives more frequent reactions and is not so reliable. Its chief value is in ruling out definitely normal gallbladders and in revealing a certain percentage of non-opaque calculi. If the gallbladder shadow is faint or absent by this method, the patient should have the added security of confirmation by the intravenous method.

Cholecystography is a valuable method in the study of the physiology of the normal gallbladder. By this method it has been determined that the gallbladder empties its contents into the duodenum in response to the ingestion of food, and to a degree which depends upon the chemical constituents of the food.

ORAL METHOD

Further Development in the Jejunal and Oral Administration of the Tetraiodophenolphthalein Sodium Salt. William H. Stewart, M. D., and Eric J. Ryan, M. D., Am. J. Roentgenol., 14: 504-512, Dec., 1925.

The jejunal tube was used in the administration of the salt and is still used by some men. By this method, after passing the tube in the early morning and checking its presence in the jejunum by the roentgen ray, a 300 c.c. of warm milk with a little cream is given to empty the gallbladder. Then at about one and one-half hours afterward, 30 to 40 grains of the iodo salt is injected in two doses and roentgenographic observations are made at four, eight, twenty-four and thirty-six-hour intervals.

Recently oral administration has been used at the clinic of the writers with good results. After a thorough cleansing of the gastrointestinal tract has been made by the ingestion of a compound licorice powder the night before, an enema is given the next morning preceding the examination of the gallbladder which is made at 10:00 a. m. The usual lunch is then allowed. At 6:30 p. m., the following meal is advised: a thick soup, creamed chicken, baked potato, bread, butter and a glass of milk. The abundance of fat causes the gallbladder to empty in from one to two hours. The gallbladder is then ready for the opaque bile. Commencing at 9:00 p. m. two enteric coated capsules containing 5 grains each of sodium tetraiodophenolphthalein are given with a wine glass of water every fifteen minutes until 8 capsules are taken. The patient reports at the office twelve hours later, at 9:00 a. m. the following morning, with an empty stomach, no breakfast being allowed. A series of roentgenograms is then taken. Four hours later, at 1:00 p. m., the examination is repeated. Regular lunch is allowed at 1:30 followed by a re-examination an hour later. The patient reports the following morning for a final examination.

It is essential to make a preliminary examination before the administration of the salt in order to exclude any lesion which may be overshadowed by the opaque bile. The starvation diet is necessary in order that the gallbladder may become fully distended when the first roentgenogram is made. In normal cases the shadow should appear at the twelfth hour, should slightly diminish in size and become more intense in outline four hours later; as soon as food has been given it should further diminish in size and detail or completely disappear. The following morning, thirty-six hours after the salt, there should be no shadow present.

In the interpretation of the cholecystography shadows the writers divide the shadows into those giving direct evidence of pathology of the gallbladder and those giving indirect evidence.

The first and most important of the direct signs is the actual visualization roentgenographically of non-opaque gallstones. These stones are, as a rule, outlined by being surrounded with the opaque bile. In some instances the roughened surfaces of the stones may absorb a sufficient amount of the dye to become visible in the roentgenograms. It is a noticeable fact that the shadows of gallstones are brought out into clearer detail after the dye, even though the gallbladder is not outlined. Mottling of the gallbladder shadow, as a rule, indicates small stones. One should be exceedingly careful in the interpretation of this sign, for intestinal gas overlapping the gallbladder shadow may produce this effect. It a painstaking examination is made, however, it will be noticed that the small round negative shadows extend beyond the gallbladder outline.

It must not be construed from the above statement that all gallstones will be visualized by the test. In a number of cases where pathology of the gallbladder was reported the surgeon at operation found not only a thickened gallbladder, but stones as well. The explanation is not entirely clear at the present time; it may be due to overshadowing. Most of these cases showed a concentrated shadow with roughness of outline.

The second direct sign is deformity of outline caused by adhesions. This is a very reliable finding and is seen quite frequently; one must be sure that it is persistent and not due to pressure. In at least two cases the greatest deformity was noted at the sixteenth hour when concentration was at its highest. The regular sequence indicating the function was apparently not interfered with. The diagnosis was confirmed surgically in both cases.

DIRECT AND INDIRECT

Relative Value of Cholecystography and the So-Called Direct and Indirect Methods of Roentgenological Examination of the Gall-Bladder. Jas. T. Case, M. D., Am. J. Roentgenol., 16:230-250, Sept., 1926.

The results obtained from cholecystography depend to a large extent upon the technique employed. Dr. Case's technique at Battle Creek Sanitarium, Michigan, represents that commonly employed for intravenous administration.

The patient appears at the office at five o'clock in the afternoon. A few necessary sterile gloves, gowns, instruments and linen are provided. The patient lies down and the arm is prepared as carefully as it would be for a blood transfusion. A rubber tourniquet is held by clamps tight enough to distend the veins assisted by the patient's clinching of the fists. An 18 gauge hypodermic needle is thrust into one of the most prominent veins, preferably median basilic, and blood is withdrawn to make sure that needle is securely within the lumen of the vessel. The hypodermic syringe is twisted loose from the needle and the end of a rubber tube, previously made ready and attached to a burette filled with warm Ringer's solution, is attached to the needle, and the tourniquet released, thus starting the flow of warm Ringer's solution into the vein. A 150 or 200 c.c. burette, such as was formerly employed in salvarsan work, is used. As soon as the flow is established, the nurse pours into the burette the solution of tetraiodophenolphthalein already prepared and this is allowed to flow into the vein diluted by the addition of 75 to 100 c.c. of warm Ringer's solution. The injection proceeds as rapidly as the gravity method permits, four or five minutes usually being sufficient. The dye is followed by 15 or 20 c.c. Ringer's solution. The patient is quiet for at least fifteen minutes. The evening meal is confined to carbohydrates.

At eight o'clock in the morning, before breakfast and fourteen to fifteen hours after the injection, the patient appears for roentgenograms. Two 8x10 films are taken in the region of the gallbladder. If satisfactory, the patient eats a breakfast of milk, cream or egg yolk and the examination terminated in the next half hour. A twelve o'clock film may be taken. "The average patient complains of no discomfort whatever and those who do complain usually suffer nothing more than a species of malaise which is gone within an hour. Those who suffer discomfort are told to take some bicarbonate of soda in hot water. In my experience with about 1,200 injections for cholecystography, several hundred of which have been given to patients outside the institution, I believe that I can definitely state that the intravenous method, when using tetraiodophenolphthaletin, is an office procedure."

GENITO-URINARY SYSTEM

BLADDER TUMORS

Four Years' Experience ip the Treatment of Tumors of the Bladder by Deep Roentgen Therapy. Charles A. Waters, M.D., Am. J. Roentgenol., 16:203-214, Sept., 1926.

The result of these years of experience has been so satisfactory that the author asserts the best treatment for superficial papillary carcinoma, whether localized or extensive, is a combination of deep roentgen ray therapy and, at the same time, applications of radium applied directly to the surface of the growth. But the great tendency to recurrence of tumors of the bladder, following their apparent destruction, whether by fulguration, radium, or deep roentgen therapy, makes it imperative that patients return at frequent intervals for cystoscopic examination.

URINARY CALCULI

Report of 1,326 Roentgen Examinations for Suspected Urinary Calculi. H. J. Walton, M. D., and J. H. Luscinian, M. D., Am. J. Roentgenol., 14:320-321, Oct., 1925.

In the roentgen examination at the Roentgen Department of the University of Maryland of 1,326 cases of suspected urinary calculi, only 16.04 per cent showed positive shadows. It was found that hypertrophic arthritis of the spine frequently gave rise to symptoms simulating those occasioned by urinary calculi.

In those in whom the diagnosis was confirmed it was found that calculi were more frequent in males than in females, the proportion being two to one. Calculi were more often found on the right side. Pyelograms also showed hydronephrosis and hydroureter to be far more common on the right side.

Gallstones may simulate renal colic, and are often difficult to differentiate without positive roentgen ray.

The size of the majority of calculi was small, being less than 1 cm. in diameter.

UTEROTUBALOGRAPHY

Uterotubal Roentgenography with Lipiodol. I. C. Rubin, M. D., and A. J. Bendick, M. D., Am. J. Roentgenol., 16: 251-255, Sept., 1926.

Lipiodol has been received by the roentgenological profession with much enthusiasm. It is appraent that the authors bestow upon it its rightful place in uterotubalography.

Lipiodol has two distinct advantages: (1) it is aseptic and antiseptic; (2) the contrast shadows are distinct and dense. The chief use of injecting lipiodol into the uterus would be to check up the non-potency of the fallopian tubes. As any other solution, lipiodol if injected into the peritoneal cavity would act as a foreign body and cause irritation. Peruterine insuffla-

tion with carbon dioxide has every advantage over radiopaque substances as a method of demonstrating tubal patency. The carbon dioxide rises immediately to the diaphragm where it is very rapidly absorbed, leaving no trace nor residue. Only after two such insufflations have demonstrated the tubes to be stenosed, should lipiodol be considered. By its use, uterine peristalsis may be demonstrated, and the point of stenoses definitely localized and proven.

PNEUMOPERITONEUM

Uber Die Bedeutung der Betastrahlen fur die Biologische Rontgenstrahlenwirkung. Von Dr. Adolf Lischti, Bern. Acta Radiol., 5:385-407, October, 1926.

The simple pneumoperitoneal method of taking roentgenograms of the female pelvic organs, so far employed, raises difficulties in the way of interpretation, particularly in respect of the relationship of these to neighboring organs. By combining this method with that of salpingo-hysterography, that is to say the filling up of the uterus and tubes with some opaque substance, such as lipiodol, the interpretation of roentgenograms is much facilitated, particularly in cases of affections of the adnexa, tubal gravidity, as well as in the differentiation from adhesions and disease conditions in neighboring organs, etc. Salpingo-hysterography alone for testing the patiency of tubes has the great advantage over simple tubal inflation of being an optic method and thus less liable to subjective misconceptions than the mere acustic ones. But just in connection with pneumoperitoneum it enables one to learn something of the nature and location of the obstruction, in addition to giving better information as regards shape and degree of development of the uterus. In the diagnosis of intrauterine changes, tumors, polypi, irregularities of the mucous membrane, they are quite able to fully replace the not harmless method of dilatation and palpation. It is in this respect that the combined method of penumoperitoneal roentgenograms and salpingo-hysterography will in future find their main usefulness for gynecological diagnosis. In a series of about 150 cases, the authors report no ill after effects.

STERILITY

The Effect of Exposure to Roentgen Rays on Reproduction in Male Rats. D. R. Hooker, M. D., Am. J. Roentgenol., 14: 327-337, Oct., 1925.

In this study, rats were submitted to various exposures from the roentgen ray and observations for the effect on sperm motility and fertility were made. It was readily found that nonmotile sperm and aspermia could result from exposure; but it was impossible to standardize the exposures so as to foretell with any degree of accuracy the effect which the various degrees of radiation would produce on the glands. This inability to obtain even an approximately consistent result is explained by the author on the difference in individual resistance.

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